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Volume 50
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Journal of Forestry

Official Organ of the Society of American Foresters

Progressive Forest Management in California[1]

DeWitt Nelson
State forester, California, Sacramento.

FOREST MANAGEMENT is a broad term that may have very different meanings to different people. While several forest properties may be operated on a managed basis, there can still be a great difference in the degree of intensity or the skill with which the forest is managed to produce maximum forest products on a continuous yield basis.

Throughout the nation there is great variety in the manner in which forests are managed, whether they be large or small, public or private. There are many elements that play a part in determining the managing policies. A few of these elements are: stability of ownership and markets for products produced; willingness of management to plan and invest for the future; availability of an adequate supply of raw material to justify long range plans and investments; recognition that forests can be cropped if properly managed; and willingness of the public to participate in the protection of the forest from fire, insects, and disease.

In California we have gone through and are still going through every phase of this experience. However, in comparison to some states we are fortunate in that the industry and the public are beginning to recognize the danger signals and are taking action to correct the mistakes of the past. We expect to have a strong and stable forest industry with a high yield of forest products in the future. We are going through a period of evolution that is marked by a progressively improving degree of management on the majority of our forest properties. This is particularly true of those properties in the medium and large ownership classes.

Forest Practices Act

California is fortunate in that it has considerably more than 200 billion board feet of old-growth timber left. The "Tree Farm" program of industry has caught hold and is progressing rapidly. Many operators are employing professional foresters to survey their forests; to develop growth and withdrawal studies; to create management plans; and to supplement public protection against fire, insects, and disease. How effectively and successfully we convert the old-growth stand into a healthy, fast growing young forest is a challenge to industry and foresters. In 1945 the leaders of industry, the State Legislature, and the State Board of Forestry undertook to meet this challenge through the enabling legislation of the Forest Practice Act. They tackled the job of changing century-old traditional methods and the job of changing timber exploitation to harvesting timber as a crop.

The establishment of new concepts of cutting practices has taken place during one of the most expansive eras of the forest industry. During this period California moved from third to second place in the nation's lumber production. There has been an advent of hundreds of small- and medium-sized sawmills; over 20 plywood and veneer mills, one hardboard, one paper, and one compressed wood fibre plant. This period saw rising stumpage prices and increased need for maximum production of lumber and forest products.

The development of Forest Practice Rules to be followed by operators cutting timber on private lands dates back to the Joint Interim Forestry Study Committee, chairmanned by Senator George Biggar from 1943 to 1945. During that period the committee and the State Board of Forestry traveled over the entire state studying forestry and allied problems in the field, and holding local hearings to learn the sentiments of the people in respect to our many wild land resource problems.

As a result of these studies and hearings, there were several important laws enacted in 1945. Briefly, these were: reorganization of the State Board of Forestry on a staggered term basis in order to assure continuity of policy; definition of the state's responsibility in respect to wild land fire protection; an act authorizing the purchase of state forests for demonstrational and experimental purposes; an act authorizing the Division of Forestry to cooperate with timberland owners in controlling forest insect infestations; the Forest Practice Act for the development and administration of forest practice rules, and an act directed to a range improvement program on brush range lands.

The forest practice act divides the state into four forest practice districts: Redwood, North Sierra Pine, South Sierra Pine, and Coast Range Pine and Fir. In each district there is a five-man forest practice committee representing large and small timber owners and operators. The committees were charged with the responsibiilty of developing minimum forest practice rules and presenting their recommendations to timber owners and opera-

[1]Paper presented at a meeting of the Division of Forest Management, Society of American Foresters, Biloxi, Miss., December 14, 1951.

tors within their respective districts at public hearings. Their final recommendations were then subjected to ballot vote requiring two-thirds approval by the timberland ownership. This was accomplished by the spring of 1947 after which the rules were approved by the State Board of Forestry and thus given full force of law. However, full force of law based upon education, persuasion, and cooperation rather than upon penalty clauses.

In each district the forest practice rules are divided into five categories; namely, cutting, logging, fire prevention, fire suppression, and insect and disease control practices. The overall degree of compliance with all the rules reached a high of 85 percent in 1950.

Minimum Diameter Limit

In each of the pine and fir districts there is a minimum diameter limit below which the operator may not cut; these range from 18 to 22 inches d.b.h. In the redwood district the operator is required to leave a minimum of four seed trees per acre, 24 inches or greater in diameter. There have been surprisingly few violations of these minimum diameter rules.

Logging Practices

The "logging practices" of the rules contain elements that do not adapt themselves to mathematical application. So far, they deal in general terms which make it difficult to secure uniform interpretation by loggers, inspectors, and the general public. They treat with the care that will be exercised by the logger in preserving reproduction and residual trees. Here the topography, the road system, the density of the old-growth timber, and reproduction make every operation a different problem and injects the principal of relative evaluation to measure results. So far, the forest practice committees have been unable to develop simple yardsticks to measure proper care in logging practices. It has been a problem of working with the men in the woods on sound practical principles to minimize damage. This has been one of the most difficult sections of the rules to evaluate and enforce. However, compliance here is above the average for all sections.

Protection

In the fields of fire prevention and suppression great strides have been made. The rules require each operator to prepare annually and submit a fire plan for his organizations to have a definite complement of fire-fighting tools at given locations during the fire season; to follow certain rules in the use of fire; to provide certain patrol after each working shift; to fall snags and dispose of slash in prescribed ways on certain areas. Many operators are going beyond rule requirements in snag falling for therein lies one of the most important fire prevention and control measures. Many operators are following an alternate plan of "lopping" their treetops over much of the area in lieu of piling and burning the slash on roadsides. Lopping is considered an excellent practice since it places the flash-fuels on the ground where they more quickly disintegrate and in many ways eliminates forest insect breeding areas. Slash disposal, particularly in the redwood region, is a tough and critical problem having both protection and silvicultural implications. Satisfactory solutions have not yet been developed. Fire-proofing around sawmills and the installation of safe waste-burning devices are now practically universally followed. On most operations of any size the operator has special fire-fighting equipment and maintains extra patrols during critical periods. In several large areas of the state the operators have joined together and provide an airplane and pilot for regular fire detection patrols which are administered by the division. With almost no exceptions the operators take prompt and aggressive action on fires within and adjacent to their operating areas. Strange as it may seem, in spite of these great strides, compliance in this category has not yet reached a satisfactory level of performance.

Results

The development of Forest Practice Rules cooperatively between the industry and the State Board of Forestry has in my opinion demonstrated the advantages of the principle of bringing business and government together in working out solutions to complex resource problems in which the public has a definite interest and on which depend so much of our future welfare and economic security.

Many persons questioned its workability because the law had "no teeth." In my judgment this was good initial legislation because we were pioneering a new field with few precedents to follow; it placed a mutual responsibility on both the industry and state government; it forced close cooperation and resulted in development of a high level of mutual confidence and respect, as well as mutual appreciation of problems.

The results may be summarized as follows:

1. Today it is a rare case when an operator, large or small, cuts below the minimum diameter rule. Many are voluntarily cutting to an even larger diameter limit.

2. There is much to be desired in regard to the logging practices that will minimize damage to reproduction and residual trees. Here is a responsibility for both management and labor if the man in the woods is to appreciate the importance of protecting trees today for the timber of tomorrow.

3. The importance of adequate fire prevention and control is appreciated by practically all operators. Some segments of the industry are studying the possibility of shutting down logging operations during periods of critical fire weather.

4. One of our most difficult problems is how to dispose of heavy slash concentrations that constitute a critical fire risk for years to come. This is particularly true of the redwood and fir areas of the north coastal region. In addition to the problem of eliminating the slash, there is the difficulty of protecting reproduction and residual timber in the process. This problem is being given careful study. There is no simple solution.

5. Today fire-proofed areas around sawmills and safe waste-burning devices are common rather

than exceptions. A fire starting in a sawmill rarely escapes to the surrounding area. That was not true a few years ago.

6. During the first three years the rules were in force, spring inspections showed severe "backsliding" in comparison to the previous fall inspections. The last two years' reports show that the spring inspections compare favorably with the previous fall's degree of compliance.

7. It is interesting and significant to note changes in attitude toward the Forest Practice Rules. At the beginning there were some operators who were openly opposed; many showed indifference, but fortunately, there were others who were in wholehearted support of the program. Today, antagonistic attitudes toward the program are rare.

This change in attitudes and an ever-improving degree of compliance with the rules have been accomplished through patience, tolerance, and understanding on the part of both the operators and the field foresters. The Redwood Logging Conference and the Sierra-Cascade Logging Conference each year are bringing more and more loggers, operators, and owners together where they discuss logging problems and forest practices in the language of the woods. To these conferences goes much credit for both understanding and improved compliance.

What of the Future?

The Forest Practice Act, as amended at the last legislative session, provides the following changes: It simplifies procedures for amending the rules upon the initiative of operators or the state forester through Forest Practice Committee action, public hearings, and State Board of Forestry approval; it provides for alternate and substitute plans when the rules do not fit local conditions, or where other methods are desirable, such plans to be approved by the District Forest Practice Committee and the State Board of Forestry; it requires timber owners to notify the state forester of logging operations which are to be started on their property; it requires operators to register with the state forester during the month of November for the succeeding year; it provides operating permits to be issued that will be conditioned on the operator's compliance with the Forest Practice Rules, which permits may be suspended or revoked for noncompliance with the rules by following the provisions of the general Administrative Procedures Act; and it stipulates that operating without a permit is a misdemeanor.

At the present time all four of the Forest Practice Committees are working on the revision of the Forest Practice Rules. It is expected that a number of progressive changes will be made and much of the general language, definitions, and rule requirements will be clarified so that more common interpretations can be secured.

The Forest Practice Rules have been successful during their first phase of operation using the tools of education, persuasion, and cooperation. On the initiative of the lumber industry, the legislative amendments of 1951 move the program into the next phase by providing an additional tool of a law with penalty provisions for those relatively few operators who refuse to comply on a voluntary basis.

The forest practice committeemen, the several industry associations, and the majority of the operators recognize, as does the State Board of Forestry, that we are cooperatively developing a regulatory program with many facets. The difference in topography, timber types, stand compositions, and volumes per acre require flexibility of controls and adaptability of methods to meet ever-changing techniques in harvesting and utilization. Since the advent of the rules, new processes for utilizing forest products have been developed within the state—more are coming. Many of these new processes will create new values for inferior species and waste materials which will require new practices in the woods. We must be ready to meet them with practical solutions.

Sound forest management is here to stay with an ever-increasing demand for improved practices in order to protect plant investment and to assure an adequate wood supply for the future.

We know that California can compete with other forest regions in timber growing if we harvest our crop intelligently, provide an adequate seed source, and protect our growing timber from fire, insects, and disease.

It was to this end that the Forest Practice Act was designed and to this future that the rules are being constantly studied and administered.

Conclusion

1. There is a rapid trend toward more "conscious" efforts in good forest management. This does not just apply to *required* practices. There is a greater appreciation of the need for growing timber *now*.

2. Timber operators, on their own, are advocating and distributing educational material on improved forest management.

3. A large percentage of the major companies and many smaller ones are thinking in terms of actual "sustained yield" operations.

4. Economics — markets and products—are rapidly shaping timberland values to the point where a smaller, but sustained volume of production (more equal to growth) is practical. Many small operators are calculating the market demands, the cost of keeping their operation going indefinitely, and including the extra expense of performing forest management practices hitherto thought to be financially prohibitive.

Speaking broadly, California has and probably always will have every type and degree of forest management represented throughout its 17 million acres of timber crop land. A metamorphosis is taking place. Management at most all levels is becoming progressively better. Progressive forest management is on the move. Professional foresters in both public and private employment have an opportunity and responsibility to keep it going forward.

Statistics from Schools of Forestry for 1951: Degrees Granted and Enrollments

Gordon D. Marckworth
Dean, College of Forestry, University of Washington, Seattle.

This article is another in a series of comparable papers appearing annually in the Journal of Forestry since 1934, reporting the enrollment at the schools of forestry and the numbers of degrees conferred. Statistics of this type were first assembled when the Forest Education Inquiry made its study in 1929-1931, and were published in the Inquiry's report in 1932.[1] The annual articles in the Journal have brought to date the figures for each successive year.[2]

In 1934 Cedric H. Guise, professor of forestry at Cornell University, brought the data on forestry school enrollments and degrees granted up to date in an article published in the JOURNAL OF FORESTRY, and in each succeeding year he compiled the statistics for the current year.[2] After eighteen years of continuous service he asked that some one else take over the job. Feeling that this contribution of Professor Guise to the cause of forestry education should be continued, the present author agreed to take over, beginning this year. Before presenting this year's statistics, I would like to pay tribute to him for his unselfish efforts over a period of eighteen years.

The 1951 statistics from the schools of forestry are on a slightly different basis than those for 1950 and previous years. During the past year all of the schools were reexamined by the Accrediting Committee of the Society of American Foresters, and as a result the Council of the Society gave accredited standing to twenty-five schools by adding those at Alabama Polytechnic Institute, the University of Massachusetts, and the University of Missouri. These schools were transferred from the non-accredited list which was further modified by dropping Harvard and Tennessee and adding Virginia Polytechnic Institute. These changes show a total of 33 schools, of which 25 are accredited and 8 non-accredited, in contrast to a total of 34 schools of which 22 were accredited and 12 non-accredited.[3]

TABLE 1.—SIGNIFICANT STATISTICS FOR 1947, 1948, 1949, 1950, AND 1951

	1947	1948	1949	1950	1951
Bachelor's degrees conferred	554	918	1,443	2,321	1,542
Master's degrees conferred	223	222	205	275	249
Doctor's degrees conferred	7	16	12	29	17
Undergraduates enrolled	7,454	8,212	7,469	5,935	4,799
Members of freshman class	2,061	1,851	1,485	1,442	1,370
Members of the sophomore class	2,878	2,178	1,667	1,379	1,107
Members of the junior class	1,577	2,497	1,816	1,384	1,053
Members of the senior class	938	1,686	2,501	1,730	1,269
Graduate students—master's	339	330	450	483	344
Graduate students—doctor's	80	93	98	118	137

Degrees Granted

During the calendar year 1951, the 33 schools of forestry awarded 1,542 undergraduate degrees, 249 master's degrees, and 17 doctor's degrees. Of the 1,542 undergraduate degrees, 1,374 or 89 percent were awarded by accredited schools and 168 by those not accredited (Table 2). The number of undergraduate degrees awarded in 1951 showed a significant drop from the all time high of 2,321 awarded in 1950. It is interesting to note that in 1949 and again in 1950 Professor Guise predicted that the number of undergraduate degrees which would be awarded in 1951 would be in the neighborhood of 1,500—a prediction which has been borne out. The number of students in the senior class is 272 less than the number who received undergraduate degrees in 1951. Furthermore, the current enrollment in each of the classes is less than the number of degrees awarded this year. This would indicate that we can expect a continued decline for at least three years. Considering these factors together with the normal mortality, the 1952 graduating class should total between 1,000 and 1,100.

The number of graduate degrees awarded also showed a decline with the number of master's degrees dropping from 275 to 249 and the doctorates from 29 to 17. The master's degrees were awarded by 19 of the 25 accredited schools, and the doctorates by 7. Duke, New

TABLE 2.—NUMBER OF DEGREES GRANTED FOR COMPLETION OF STUDIES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE CALENDAR YEAR 1951

	Undergraduate degrees	Master's degrees	Doctor's degrees
Accredited schools:			
1. Alabama	30		
2. California	58	5	1
3. Colorado	56	7	
4. Duke		45	4
5. Florida	37	8	
6. Georgia	58	3	
7. Idaho	50	10	
8. Iowa	82		
9. Louisiana	45	3	
10. Maine	52	1	
11. Massachusetts	8		
12. Mich. State	42	13	1
13. Mich. Univ.	90	34	2
14. Minnesota	66	11	2
15. Missouri	23		
16. Montana	73	5	
17. New York	151	40	2
18. N. Carolina	40	5	
19. Oregon	86	5	
20. Pennsylvania	94	9	
21. Purdue	59		
22. Utah	57	12	
23. Wash. Univ.	70	3	
24. West Virginia	47		
25. Yale		30	5
Total	1,374	249	17
Not accredited schools:			
1. Connecticut	13		
2. La. Poly.	25		
3. Mich. Mining	23		
4. New Hamp.	17		
5. Oklahoma	30		
6. Texas (S. F. Austin)	10		
7. Va. Poly.	24		
8. Wash. State	26		
Total	168		
Grand total	1,542	249	17

[1]Graves, H. S. and C. H. Guise. Forest education. Yale Univ. Press, New Haven. 1932.

[2]Guise, C. H. (Eighteen articles on degrees granted and enrollments at schools of forestry in the United States, 1934-1948.) Jour. of Forestry 32:337-343; 33:402-405; 34:114-120; 35:77-83; 36:12-18; 37:197-202; 38:241-246; 39:359-364; 40:196-202; 41:87-91; 42:357-360; 43:172-175; 44:110-114; 45:174-180; 46:168-173; 47:93-100; 48:165-169; 49: 7-12.

[3]Jour. Forestry 49:143-144 and 672.

TABLE 3.—NUMBER OF DEGREES GRANTED FOR COMPLETION OF STUDIES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE CALENDAR YEARS 1900-1951

Years	Undergraduate degrees	Master's degrees
1900	1	—
1901	5	—
1902	2	9
1903	3	14
1904	9	29
1905	9	34
1906	24	24
1907	19	27
1908	31	35
1909	47	44
1910	61	48
1911	100	61
1912	122	54
1913	136	37
1914	151	42
1915	124	35
1916	151	36
1917	160	27
1918	65	10
1919	53	6
1920	160	25
1921	126	26
1922	141	44
1923	217	31
1924	215	43
1925	280	44
1926	259	58
1927	263	50
1928	302	64
1929	291	54
1930	308	69
1931	394	97
1932	380	78
1933	355	65
1934	337	47
1935	423	58
1936	502	67
1937	803	75
1938	980	95
1939	1,102	112
1940	1,072	105
1941	834	117
1942	654	76
1943	446	28
1944	106	12
1945	51	18
1946	192	65
1947	553	223
1948	918	222
1949	1,443	205
1950	2,321	275
1951	1,542	249
Total	19,243	3,369

York State College of Forestry, University of Michigan, and Yale lead in the number of master's degrees awarded, accounting for 149 of the 249 total, while Yale and Duke awarded 9 of the 17 doctor's degrees.

Summarizing past enrollment records, we find that a total of 19,243 bachelor's degrees, 3,369 master's degrees, and 46 doctor's degrees have been awarded since 1900 (Table 3).

Enrollments

Tables 4 to 10 deal with enrollments at the schools of forestry, both individually and collectively. In all cases only students who are regularly enrolled as candidates for a degree are included.

TABLE 4.—ENROLLMENTS BY CLASSES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1951-52

	Accredited schools	Freshman	Sophomore	Junior	Senior	Total under graduates	Graduates Masters	Graduates Doctors
1	Alabama	19	22	8	26	75	—	—
2.	California	20	31	51	66	168	7	9
3.	Colorado	132	34	51	53	270	20	—
4.	Duke						22	16
5.	Florida	30	25	21	21	97	5	—
6.	Georgia	17	25	30	46	118	3	—
7.	Idaho	48	35	38	42	163	13	—
8.	Iowa	39	54	34	47	174	5	1
9.	Louisiana	35	29	16	26	106	10	—
10.	Maine	77	59	43	30	209	3	—
11.	Massachusetts	19	14	5	10	48	—	—
12.	Michigan State	36	26	32	30	124	8	12
13.	Michigan Univ.	19	27	58	68	172	62	38
14.	Minnesota	45	55	39	43	182	10	6
15.	Missouri	35	24	15	22	96	3	—
16.	Montana	28	47	49	50	174	10	—
17.	New York	170	150	113	146	579	69	33
18.	North Carolina	59	43	30	49	181	10	—
19.	Oregon	55	67	58	67	247	10	—
20.	Pennsylvania	118	63	74	77	332	11	—
21.	Purdue	41	34	24	44	143	6	3
22.	Utah	44	34	39	51	168	22	2
23.	Wash. Univ.	53	38	51	58	200	12	8
24.	West Virginia	34	25	38	33	130	—	—
25.	Yale						23	9
	Total	1173	961	917	1105	4156	344	137
	Not accredited							
1.	Connecticut	20	11	9	16	56	—	—
2.	La. Polytech.	27	10	8	13	58	—	—
3.	Mich. Mining	33	25	32	29	119	—	—
4.	New Hampshire	21	13	13	22	69	—	—
5.	Oklahoma	43	32	29	27	131	—	—
6.	Texas	9	6	11	11	37	—	—
7.	Virginia Poly.	29	27	22	28	106	—	—
8.	Wash. State	15	22	12	18	67	—	—
	Total	197	146	136	164	643		
	Grand total	1370	1107	1053	1269	4799		

The undergraduate enrollment which reached its peak in 1948-1949 with 8,212 students, continued to decline to a new post-war low of 4,799. This is approximately 58.5 percent of the 1948-1949 peak and is 1,136 less than last year's total. There is every indication that this decline will continue and that the enrollment next year will be approximately 4,000.

Enrollments by Classes

The heavy influx of students following the end of the war is still evident in this year's senior class which has a total enrollment of 1,269. While this number is 461 less than last year's and approximately half the 1948-1949 peak, it is still the fourth largest senior class on record. With 216 fewer students in the junior class, a further decline is evident for next year.

In both the junior and sopho-

TABLE 5.—UNDERGRADUATE ENROLLMENTS AT SCHOOLS OF FORESTRY IN THE UNITED STATES, 1903-1904 TO 1951-1952

Year	Enrollments	Year	Enrollments
1903-1904	19	1927-1928	1,957
1904-1905	39	1928-1929	2,079
1905-1906	51	1929-1930	2,123
1906-1907	98	1930-1931	2,120
1907-1908	143	1931-1932	2,573
1908-1909	258	1932-1933	2,388
1909-1910	357	1933-1934	2,246
1910-1911	518	1934-1935	3,791
1911-1912	591	1935-1936	5,406
1912-1913	637	1936-1937	6,032
1913-1914	868	1937-1938	6,067
1914-1915	904	1938-1939	5,144
1915-1916	944	1939-1940	4,487
1916-1917	897	1940-1941	3,763
1917-1918	560	1941-1942	2,881
1918-1919	498	1942-1943	2,326
1919-1920	927	1943-1944	503
1920-1921	1,092	1944-1945	571
1921-1922	1,363	1945-1946	1,473
1922-1923	1,347	1946-1947	7,010
1923-1924	1,439	1947-1948	7,454
1924-1925	1,624	1948-1949	8,212
1925-1926	1,771	1949-1950	7,469
1926-1927	1,880	1950-1951	5,935
		1951-1952	4,799

TABLE 6.—UNDERGRADUATE FALL-TERM ENROLLMENTS BY CLASSES IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1933-1934 TO 1951-1952

Academic years	—Freshmen— Enrollment	Change	—Sophomores— Enrollment	Change	—Juniors— Enrollment	Change	—Seniors— Enrollment	Change	—Totals— Enrollment	Change
1929-1933 averages	773		597		476		398		2,244	
1933-1934	783		628		467		368		2,246	
1934-1935	1,751	+ 968	930	+ 302	671	+ 204	439	+ 71	3,791	+1,545
1935-1936	2,301	+ 550	1,587	+ 657	943	+ 272	575	+ 136	5,406	+1,615
1936-1937	2,044	— 257	1,771	+ 184	1,402	+ 459	815	+ 240	6,032	+ 626
1937-1938	1,919	— 125	1,656	— 115	1,378	— 24	1,114	+ 299	6,067	+ 35
1938-1939	1,403	— 516	1,235	— 421	1,294	— 84	1,212	+ 98	5,144	— 923
1939-1940	1,259	— 144	1,095	— 140	922	— 302	1,141	— 71	4,487	— 657
1940-1941	1,000	— 259	975	— 120	857	— 135	931	— 210	3,763	— 724
1941-1942	771	— 229	672	— 303	709	— 148	729	— 202	2,881	— 882
1942-1943	845	+ 74	580	— 92	404	— 305	497	— 232	2,326	— 555
1943-1944	199	— 646	94	— 486	101	— 303	109	— 388	503	—1,823
1944-1945	321	+ 122	114	+ 20	64	— 37	72	— 37	571	+ 68
1945-1946	840	+ 519	315	+ 201	205	+ 141	113	+ 41	1,473	+ 902
1946-1947	3,611	+2,771	1,840	+1,525	914	+ 709	645	+ 532	7,010	+5,537
1947-1948	2,061	—1,550	2,878	+1,038	1,577	+ 663	938	+ 293	7,454	+ 444
1948-1949	1,851	— 210	2,178	— 700	2,497	+ 920	1,686	+ 748	8,212	+ 758
1949-1950	1,485	— 366	1,667	— 511	1,816	— 681	2,501	+ 815	7,469	— 743
1950-1951	1,442	— 43	1,379	— 288	1,384	— 432	1,730	— 771	5,935	—1,534
1951-1952	1,370	— 72	1,107	— 272	1,053	— 331	1,269	— 461	4,799	—1,136

TABLE 7.—FALL TERM ENROLLMENT OF GRADUATE STUDENTS IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1931-1932 TO 1951-1952

	Master's	Doctor's	Total
1931-1932	173	26	199
1932-1933	174	32	206
1933-1934	80	37	117
1934-1935	104	18	122
1935-1936	114	25	139
1936-1937	151	28	179
1937-1938	150	34	184
1938-1939	253	40	293
1939-1940	213	34	247
1940-1941	212	39	251
1941-1942	137	45	182
1942-1943	30	24	54
1943-1944	30	7	37
1944-1945	20	10	30
1945-1946	108	16	124
1946-1947	376	49	425
1947-1948	339	80	419
1948-1949	330	93	423
1949-1950	450	98	548
1950-1951	483	118	601
1951-1952	343	137	480

TABLE 8.—ENROLLMENTS OF VETERANS AND NONVETERANS AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR FALL TERM 1951-52 (SPECIAL STUDENTS EXCLUDED)

Accredited schools	Undergraduates Veterans	Undergraduates Non-veterans	Graduates Veterans	Graduates Non-veterans	Total Men	Total Women
1. Alabama	12	63			75	
2. California	62	105	16		183	1
3. Colorado	91	179	18	2	290	
4. Duke			31	7	38	
5. Florida	32	65	4	1	102	
6. Georgia	48	70	1	2	121	
7. Idaho	45	118	4	9	176	
8. Iowa	31	143	5	1	180	
9. Louisiana	32	74	6	4	116	
10. Maine	52	157	3		212	
11. Massachusetts	3	45			48	
12. Michigan State	35	89	10	10	144	
13. Michigan University	49	122	62	38	271	1
14. Minnesota	33	148	11	5	197	1
15. Missouri	24	72	2	1	99	
16. Montana	81	92	9	1	183	1
17. New York	98	481	75	26	680	1
18. North Carolina	57	124	7	3	191	
19. Oregon	88	159	6	4	257	
20. Pennsylvania	162	170	10	1	343	
21. Purdue	39	104	8	1	152	
22. Utah	72	96	21	3	192	
23. Washington Univ.	68	131	12	8	219	1
24. West Virginia	39	91			130	
25. Yale			18	14	32	
Total	1253	2898	339	141	4631	6
Not accredited						
1. Connecticut	14	42			56	
2. Louisiana Poly.	17	41			58	
3. Michigan Mining	28	91			119	
4. New Hampshire	11	58			69	
5. Oklahoma	31	100			131	
6. Texas (S. F. Austin)	8	29			37	
7. Virginia Poly.	23	83			106	
8. Washington State	11	56			67	
Total	143	500			643	
Grand total	1396	3398	339	141	5274	6

more classes the enrollment is beginning to become stable with decreases of only 331 and 272 respectively. The junior class will probably show a slight decline again next year, but with the development of the junior college program, no definite predictions can be made. Next year's sophomore enrollment should be about the same as this year's.

The freshman class with 1,370 students has 72 fewer students than in 1950-1951. Last year the decline from the previous year was 43 compared to the drop of 72 this year. While there has been a slight drop, there has actually been very little change in the freshman class over the past three years. There is little information upon which to forecast the freshman enrollment next year. However, on such as is available, I would predict an enrollment of about 1,400.

That forestry is still a man's profession is emphasized by the few women who are regularly enrolled in the schools of forestry throughout the nation. Of the 4,799 undergraduate students enrolled this year, only 5 are women. Four

TABLE 9.—VETERAN AND NONVETERAN ENROLLMENTS CLASSIFIED BY UNDERGRADUATE AND GRADUATE GROUPS FOR YEARS 1948-1949 TO 1951-1952

	1948-1949		1949-1950		1950-1951		1951-1952	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Undergraduates	8,212	100	7,469	100	5,935	100	4,799	100
Veterans	6,199	75	4,591	61	2,544	43	1,396	29
Nonveterans	2,013	25	2,878	39	3,391	57	3,403	71
Graduate students	423	100	548	100	601	100	481	100
Veterans	325	77	450	82	447	74	339	70
Nonveterans	98	23	98	18	154	26	142	30

TABLE 10.—VETERANS AND NONVETERANS IN UNDERGRADUATE AND GRADUATE CLASSES 1951-1952

	Veterans		Nonveterans			Total
			Men	Women		
	Number	*Percent*	*Number*	*Number*	*Percent*	
Freshmen	81	6	1289		94	1370
Sophomores	256	23	847	4	77	1107
Juniors	426	40	627		60	1053
Seniors	633	50	635	1	50	1269
	1396	29	3398	5	71	4799
Masters	243	71	101		29	344
Doctors	96	70	40	1	30	137
Total	1735	33	3539	6	67	5280

of these are sophomores at the universities of California, Michigan, Minnesota, and Washington, and the fifth is a senior at Montana State University.

Graduate Enrollments

Graduate enrollment is confined to 22 of the 25 accredited schools. The enrollment for the master's degree dropped from 483 to 344, while for the doctorate it increased from 118 to 137. New York again has the largest enrollment for the master's degree with 69, but is followed closely by Michigan State College with 62. In the field of the doctorate these two institutions change places with Michigan State having 38 candidates and New York 33.

The decrease in the number enrolled for the master's degree is probably caused by a decrease in the number of qualified veterans who are still eligible to receive G. I. schooling. On the other hand, the increase in the number of candidates for the doctorate is undoubtedly due in part to the veteran's program and in part to the increasing importance placed upon the degree by educational and research organizations.

Enrollment of Veterans

During the current year there are 5,280 men and women enrolled in schools of forestry throughout the country. Of these only 1,735, or 33 percent are veterans. Of the 4,799 undergraduates, only 1,396 or 29 percent are veterans compared to 43 percent last year, and 80 percent in 1947-1948. As is to be expected, the largest number and the largest percentages of veterans are to be found in the senior class, with 633 students comprising 50 percent of the class. In the other undergraduate classes they make up only 6 percent of the freshmen, 23 percent of the sophomores, and 40 percent of the juniors.

While there is a slight drop in the percentage of veterans who are taking graduate work, it is still high and comprises 70 percent. Last year it totalled 74 percent, and 82 percent in the preceding year. The breakdown of the veteran enrollment statistics is shown in Tables 8, 9, and 10.

Summary

The decline in enrollment which began in the 1949-1950 scholastic year has continued. All available evidence points to a further decline in all the undergraduate classes next year, with the possible exception of the freshman class. The veteran enrollment has decreased to such an extent that it is no longer the dominant factor in the enrollment picture. Today the veterans make up only 33 percent of the total enrollment compared to 80 percent four years ago. Graduate enrollment is still high though there has been a falling off this year. This is caused by a drop in the number of master's candidates, since the number registered for the doctorate continues to increase. The decline in the enrollment is reflected in the number of degrees awarded, which reached its peak in 1950.

Have You These Books?

During the 1920's, the Society of American Foresters participated in two studies which were subsequently published in book form. The Society's executive office does not possess a copy of either book. If any readers of the JOURNAL have copies of these books which they would be willing to make available to the Society, the executive staff will be most grateful. The publications are:

A National Program of Forest Research, prepared by Earle H. Clapp as the report of a special committee on forest research of the Washington Section, Society of American Foresters, consisting of R. C. Hall, A. B. Hastings, and E. H. Clapp. Published by the American Tree Association for the Society of American Foresters in 1926.

The Role of Research in the Development of Forestry in North America, by Bailey and Spoehr. This study was financed by the General Education Board at the suggestion of the National Academy of Sciences. The book was published in 1928.

Public Forest Policy in a National Emergency[1]

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This paper discusses some impacts of the current national emergency on forest conservation, effects of the present emergency on long-run forestry goals, and some special problems that forestry faces because of emergency conditions. It describes (1) some special federal activities that contribute to forest policy formation, and (2) Forest Service policies with particular reference to the current emergency. It does not discuss the adaptation of state forest policies to emergency conditions.

From 1941 to 1945 the emergency that confronted our country was very definite and tangible, and presumably of limited duration. We were engaged in an all-out war. It could be expected that the emergency would end when the war was won. The national emergency that confronts us today is no less real, but it is different from anything we have experienced in the past. We now have the responsibility of leadership in a world-wide struggle against Communism. The terrible and costly fighting that has been going on in Korea is the most tangible phase of this struggle, and in itself is a military operation calling for large-scale expenditures of resources and manpower. But it is only part of the world-wide conflict. Because of the Communist threat to the free world, we have been forced to embark upon a rearmament program far beyond that required for the Korean episode. It is our hope that adequate preparedness for defense will avert a third world war.

The present national emergency was officially declared on December 16, 1950, by proclamation of the President. How long it will continue as an officially declared emergency will depend upon specific world events. Actually, except for a brief hiatus between World War II and Korea, we have been in an emergency status since before Pearl Harbor in 1941. The national emergency will continue, officially or unofficially, so long as the forces of totalitarian aggression continue to threaten our free people and free institutions. There is every prospect that it will last a long time, and that what we are calling an emergency now will come to seem like the normal situation.

Public forest policy therefore must be geared to long-term considerations. While it recognizes immediate military and other emergency needs, it must at the same time consider probable future requirements. Since a strong military defense establishment can be maintained only on the foundation of a sound national economy, public forest policy must recognize civilian uses and needs as well as those of the military. It must recognize the long-term nature of the timber-growing enterprise, and the length of time that may be necessary to adjust the forests for the proper implementation of a long-range policy. Because of these essential long-term considerations, public forest policy is not susceptible to drastic short-term manipulation.

Special Functions of Forest Policy Leadership by the Federal Government

In addition to the normal policy functions of the Congress and of federal forestry agencies, a number of special government activities now under way are contributing to the development of public forest policy in relation to the national emergency. In most of these activities policy has not yet evolved, so this discussion must be primarily a description of the activity, rather than an enunciation of forest policy resulting from that activity.

Materials Policy Commission

In January 1951, the President established a special Materials Policy Commission to study the broader and longer range aspects of the nation's materials problem as distinct from immediate defense needs. This commission, under the chairmanship of William S. Paley, president, Columbia Broadcasting System, is inquiring into major aspects of the materials and resources problem in order to determine whether shortages of production materials threaten to hamper the economic growth and military security of the United States and of the whole free world in the decades immediately ahead and, if so, what national policies should be pursued in order to avert such shortages. In establishing the commission, the President said: "This is one of the crucial problems facing the Nation. By wise planning and determined action we can meet our essential needs for military security, civilian welfare, and the continued economic growth of the United States. We cannot allow shortages of materials to jeopardize our national security or to become a bottleneck to our economic expansion."

Recommendations regarding forest resources will be included in the commission's report to the President, scheduled for completion early in 1952. It is likely that the commission's pronouncements on policy and program will contribute in an important way to the determination of official views of the Executive Branch of the government. This is one way in which the federal government is exercising over-all leadership in forest policy formation.

Long-range Goals

As a basis for emergency policy determination, there is need for careful estimates of future requirements and of the timber growth rates needed to meet those requirements. Long-range estimates were a part of the Forest Reappraisal completed by the Forest Service in 1946. Estimates of the future re-

[1]Paper presented at a meeting of the Division of Forest Economics, Society of American Foresters, Biloxi, Miss., December 14, 1951.

quirements have recently been revised by the Forest Service for use of the President's Materials Policy Commission, in the light of assumptions furnished by the commission. The commission's definition of "requirements" is based on assumptions as to the international situation, military preparedness, price relationships, population increase, and increase in gross national product differing from those used in the 1946 Reappraisal. Nevertheless the revised over-all estimates of future annual requirements are quite close to those of 1946.

The revised estimates cover prospective requirements for various classes of forest products in 1975.[2] The 1975 requirement for lumber is estimated at 10 percent more than 1950 consumption, or 45 billion board feet.

The indicated total U. S. pulpwood requirement for 1975 (for all paper and paperboard products and for rayon, plastics, and other chemical products) is some 50 percent more than was consumed in 1950. Estimates of total requirements for veneer and plywood also increase some 40 percent over 1950, predicted partly on the trend now in evidence toward use of smaller and lower grade logs. Declines in consumption of fuelwood, cooperage, hewn ties, and poles and piling are anticipated; along with moderate increases in use of mine timbers, posts, and miscellaneous products.

In terms of volume of all timber in trees of 5 inches d.b.h. and up, 1975 domestic requirements are estimated at 14.7 billion cubic feet, as compared with a 1950 consumption of 12.1 billion cubic feet. The sawtimber requirements for 1975 are estimated at 64.2 billion board feet as compared with a 1950 consumption of 52.2 billion board feet. Sawtimber makes up about 80 percent of present timber consumption.

[2]The requirements and growth data given herein are Forest Service estimates. There has been no formal acceptance of them by the President's Materials Policy Commission, and the extent to which they may be accepted or adjusted by the commission is not known.

To meet these estimated requirements of 1975 without impairment of growing stock or forest capital will, of course, call for annual timber growth of comparable volume. In addition there should be reasonable allowances for new uses of wood, for export to friendly nations, for unavoidable losses from fire, insects, diseases, storms, etc., and for special emergency needs. The total annual timber growth goals, therefore, should be placed at something like 18 billion cubic feet of all timber, including 72 billion board feet of sawtimber.

On the basis of present trends, including a probable substantial increase in the area under management during the next quarter century, the total all-timber growth that might be expected in 1975 will be about 16 million cubic feet. The 1975 annual sawtimber growth might be about 41 billion board feet. Thus, annual growth of all timber, without regard to species, quality, or size, would slightly more than meet the estimated domestic requirements. It would be about 10 percent short of the goal of 18 billion cubic feet, which allows a reasonable margin of safety. The 41 billion board feet of sawtimber growth will be only about 60 percent of domestic requirements, plus unavoidable losses in 1975. It would still need to be increased substantially to achieve the growth goal of 72 billion feet.

The policy deduction from these figures is that, despite present trends as shown by recent and prospective progress, there is still a very large job ahead to bring growth up to prospective requirements.

Foreign Forestry Relations

Our international trade in forest products and our international relations with respect to forestry matters have a bearing on public forest policy. Through reciprocal trade agreements with other nations, the United States is seeking to promote a healthy international trade. Our country is dependent on other free world nations, and they in turn are dependent on us, for certain specific forest products.

About one-third of our total paper and paperboard requirements, and more than 80 percent of our newsprint, are being met by imports, mainly from Canada. We import quantities of cabinet woods and other specialty woods from Latin America and elsewhere. Prior to World War II, the United States was a net exporter of lumber, but since the war our yearly lumber imports have exceeded exports by a substantial margin. In other words, even though we are the world's largest producer of lumber and of pulp and paper, we are not fully meeting our own domestic needs for these products.

At the same time, much of the rest of the free world is chronically deficient in forest products, especially in softwood construction lumber. Very few countries are now producing lumber sufficient to meet their own needs, and fewer yet have a surplus. The United States is not one of these. It is currently one of the timber-deficient countries, although potentially capable of developing and sustaining an output of forest products adequate to meet its prospective domestic requirements plus a desirable margin for export.

With increasing population, more industrialization, and rising standards of living, the free world's requirements for forest products are certain to increase in the future. If these growing world-wide requirements are to be met, extraordinary measures will be necessary to build up forest productivity in all those countries which have greater timber-growing potentials.

Toward this end, the United States is participating actively in the work of the Forestry and Forest Products Division of the United Nations Food and Agriculture Organization (FAO), which seeks to aid and encourage the development of sound forestry programs by member nations. The work of the Economic Cooperation Administration and activities in connection with the so-called Point IV program include technical and economic aid toward development of the forest resources of the underdeveloped countries. The loan of a number of top-flight American for-

esters for technical assignments in foreign countries has been an important contribution.

These international aspects of the forest situation inevitably affect our forest policy with respect to domestic requirements, production, and consumption. With the free world as a whole suffering from an undersupply of forest products, especially the softwood products, it is clearly to the interest of the United States to work toward the objective of meeting its own domestic requirements insofar as possible, and toward making possible an expansion of exports to friendly nations.

Comprehensive River Basin Planning

Forestry has an important part in the sound economic and social development of river basins. In 1949 the President appointed a Water Resources Policy Commission to make a study of the nation's water resources and to recommend a national water resources policy. The commission's report and recommendations, which were completed last year, are now being reviewed by a number of government agencies under the leadership of the Bureau of the Budget. The objective of this review is to recommend to the President a course of action with respect to the report, including specific suggestions regarding needed legislation, executive orders, or other administrative action. Forest lands are deeply involved in this consideration.

The Federal Inter-Agency River Basin Committee was established in 1943 as a facilitating mechanism to encourage greater inter-agency cooperation and correlation in river basin program development. Represented on this committee are the departments of the Army, Agriculture, Interior, and Commerce, the Federal Power Commission, and the Federal Security Agency.

The Inter-Agency Committee has undertaken the development of comprehensive agricultural programs including forestry for the Columbia, Missouri, and Arkansas-White-Red River basins, and for the New England-New York region. There is widespread participation by state agencies in this work.

In planning these comprehensive agricultural programs the Department of Agriculture aims to achieve maximum social and economic benefits through coordinated programs for the protection and improvement of the land and watershed resources, including farm lands, forests, and ranges. Such programs will, of course, contribute in a major way to over-all policy development as regards forestry. They will be long-term programs in the main, of high priority in building up the basic economy and strength. Some measures, moreover, such as restoration and improvement of certain critical watershed areas to reduce danger of damaging and costly floods or to increase usable supplies of water needed by defense industries, definitely will yield quick results of high priority for the immediate emergency.

Family Farm Policy Review

In November 1950, the Department of Agriculture initiated a country-wide review of all its programs and policies, including forestry, to determine how these are serving family farms and farm families, and how they can be made to serve family farming more fully. The study includes forestry matters, because more than three million farms include forest lands, and because forestry programs affect farming and farmers in many ways.

Certain groups have attempted to distort the purpose of the Family Farm Policy Review and make it a political issue. Actually the study aims at critical analysis and review of the Department of Agriculture's programs. The objectives are, first, to determine what improvements can be made in the department's service to family farming under existing authority and to put these improvements into effect, and, second, to determine what is needed further to improve or to extend the department's service to agriculture and to develop a comprehensive set of recommendations for such further improvements for presentation to Congress. The Family Farm Policy Review thus should influence policy formation at the top level. It should result in the eventual formulation of improved national policies for the well-being of American agriculture; and forestry is an essential and integral part of American agriculture.

Forest Service Policies in Relation to the Emergency

Now, I want to turn from general federal activities influencing forest policy and deal more specifically with Forest Service matters. Obviously, I cannot attempt to catalog here all the basic policies of the Forest Service; I shall mention only a few having the most direct bearing on the current emergency. In some cases certain adjustments in policy have been necessary because of the emergency situation; in others the situation has called for a reaffirmation of policies that point at the emergency.

Fire Protection

The defense emergency plainly calls for adequate and effective protection of forest and wild lands from fire. The direct damage that fires can do to timber, range, and watershed resources, to property, and to human life, is a matter of concern in the defense effort. Furthermore, fires can disrupt communications and transportation; they can tie up logging and other industrial operations, and drain manpower from important work on farms and in factories. Forest Service policy aims at adequate fire protection for all forest lands as one of the basic elements in a national program of forestry. In addition, certain special policy considerations are necessary in view of the emergency situation, including recognition of the possibility of fire attacks on this country's forests through enemy action.

Under auspices of the Federal Civil Defense Administration, the Forest Service, in cooperation with the Department of the Interior and the state foresters, early in 1951 began the preparation and assembly of comprehensive plans for protection of all the Nation's forest lands. A national committee with representatives of federal and state forestry agencies was set up to

coordinate this emergency fire protection program. Under this committee's direction, Master Wild Land Operational Fire Plans have been developed for 43 states covering both public and private lands. They provide for quick mobilization of all available fire-fighting personnel and equipment whenever needed, and show what additional personnel, equipment, and facilities might be required to prevent a fire disaster from developing. These fire plans altogether cover more than a billion acres of forest and range land in the United States and Alaska.

Research

The Forest Service has reoriented its research program, particularly in forest products and to a lesser degree in economics, to meet defense needs. At the Forest Products Laboratory a number of special defense projects are in progress. Several of these, such as investigations to determine the best designs for shipping containers and the development of design criteria for sandwich construction, have been undertaken at the direct request of and are financed by the military services. Others, that continue studies undertaken to meet peace-time needs, will have defense applications as well.

The Forest Economics Division has made or is making several special investigations. A national defense project started during this year as a service to the National Production Authority and other defense agencies involves a survey of equipment, supplies, and manpower used by primary forest products industries in the several forest regions of the United States as a basis for estimating prospective needs during the emergency period. A special study of military use of lumber and other forest products during World War II, including an analysis of procurement problems, was made by the Forest Service for the Army Corps of Engineers. Studies are under way for other government agencies on forest resources and industries in foreign countries.

The Forest Service believes its research program should remain, as always, in a somewhat flexible status. It is undesirable to attempt to reorient research entirely to so-called "emergency" conditions at the expense of many "normal" or "peace-time" projects. Often the latter, sometimes with a shift in emphasis, contribute in valuable and unforeseen ways to our national security.

Timber Sales

Long-range policy of the Forest Service calls for the development and more intensive management of the timber resources of the national forests. As a result of the emergency, action to implement this policy has been accelerated. The situation today is in marked contrast to pre-World War II days, when some individuals and groups favored curtailment of national-forest timber sales on the ground that the public timber was coming on the market in competition with private timber. Today forest industry is calling on the Forest Service to make more national-forest timber available.

As a result of the accelerated timber-sales policy the annual timber cut on the national forests has practically doubled since 1943. The volume of timber cut from the national forests in fiscal year 1951 was the largest for any year since the national forests were established. This record cut totaled nearly 4.7 billion board feet. It was an increase of more than a billion board feet over the volume cut in the preceding year. Prices received for stumpage also have risen materially. The average stumpage price per thousand board feet last year was $10.20, as compared with $2.79 ten years ago.

This acceleration in timber sales is deliberate. It would be even greater if additional manpower for preparation of timber sales and facilities for carrying out the sales were available. It is the objective of the Forest Service to get all timber working circles in the national forests operating at full sustained-yield capacity as rapidly as may be reasonably possible.

The national forests are still seriously deficient in suitable road mileage needed for maximum utilization and proper management of the timber. Lack of access roads is one of the principal bottlenecks to acceleration of national forest timber sales. It is estimated that the sustained yearly cut from the national forests could be increased to some 6 billion board feet if approximately 4,500 miles of additional main-line access roads were provided. Such roads would also make possible the salvaging of large amounts of insect, disease, and fire-killed timber and windthrow that cannot now be salvaged. The Forest Service is aggressively pushing for appropriate road development in order to make additional timber available.

It is estimated that with full development and intensive management of the timber resources, the sustained output from the national forests can eventually be more than doubled. With the increasing requirements of a probable long-term emergency, and with the expanding economy that may be expected when the emergency ends, the increased output from the national forests will be badly needed in the years ahead.

The pre-eminence of the policy for acceleration of timber sales has diverted men and money from needed work for the balanced development of national forest resources. As a result, needed timber stand improvement, reforestation, insect and disease control, as well as recreation, range, and wildlife management work is being delayed. Some of these are long-term projects, and therefore difficult to justify before Congress when that body is under pressure to reduce deficit spending and to make large military appropriations. Because of the probable long-term nature of the emergency, however, resource development and improvement projects of this sort may be of as much or more importance than immediate timber sales.

Defense Production Activities

In addition to the research services mentioned earlier, the National Production Authority is relying on the Forest Service for timber resource information needed to administer defense action programs

concerned with forest products. Under the defense program, government loans and accelerated tax amortization are authorized for plant expansions contributing to the defense effort. When proposed plant expansions involve forest products, the National Production Authority refers the proposals to the Forest Service for advice as to adequacy of the timber supply.

The Forest Service investigates the timber supply situation in the territory tributary to the proposed plant expansions. It has reported favorably on proposed expansions of plant facilities wherever the timber supply is adequate to support such expansions. It does not favor plant expansions which would cause an excessive concentration of wood-using plant capacity in an area, and thus disrupt existing industry or jeopardize sound long-term developments by causing overdrain and depletion of the forest resource.

In reporting on the proposed expansions, the Forest Service does not express an opinion as to the need for the product in the defense effort, or to the comparative need for different forest products that could be manufactured from the same standing timber.

In the aggregate, the proposed expansions will represent a substantial increase in drain on the Nation's timber resources. The installed plant capacity in many forest areas is already in excess of the growth rate of the local timber, but there are a number of places where expansion of plant capacity is based on increased utilization of hitherto little-used species, or of mill or wood waste. This is especially desirable from a forestry standpoint. Others are in locations where, because of improved fire protection, management, and planting programs, the prospects for timber supply are good, even though current growth-drain relationships are less favorable.

Most of the applications were for additional expansions in the pulp and paper industry. Others were for increased facilities for production of softwood plywood, rayon textiles, and lumber, and for wood treating plants. A large proportion of the applications contemplate plant expansions in the southern states, although substantial applications have also been received from the Northeast, Lake States, and West Coast.

Long-range Policy

All these special defense programs—concerned with fire protection, research, acceleration of national forest timber sales, and defense production activities—have been developed within the framework of basic Forest Service long-range policy. That over-all policy remains unchanged. As has been publicly stated many times, it calls for action along three main lines—complementary to each other and of equal importance.

Basic Forest Service policy looks to further expansion of public aids and services to private forest owners in order to encourage and facilitate their progress toward the practice of the best practicable forestry. These public aids include the strengthening of cooperative protection against fire, insects, and diseases; technical assistance to private owners, especially the owners of small holdings; education and demonstration; increased cooperative aid for the acceleration of forest planting on private lands; publicly sponsored systems of forest credit and forest insurance; and strengthening and expansion of all phases of forest research.

Forest Service policy calls for definite action to prevent further deterioration of forest resources in the United States and to help maintain a reasonable growing stock as a basis for future production. It calls for protection of the public investment in forestry made under the inducement programs mentioned above. The plan advocated is a system of public regulation of cutting and other forest practices, administered by the states. Because of the national interests involved, to assume a consistent pattern, and because the states will not do the job without stimulus, the basic standards should be set up by federal law.

The third phase of basic Forest Service policy calls for the development and intensified management of public forests. The national forests should include some 35 million acres of intermingled private lands within their boundaries, as well as certain key watersheds and certain areas not suited to permanent private forestry. State and community forests likewise should be expanded and more intensively managed. Fully developed, the public forests—federal, state, and community—can contribute increasingly to the Nation's security and economic progress.

The Forest Service sees no reason to depart from this basic three-point program because of the present emergency. On the contrary, the prospective long-term nature of the emergency emphasizes the importance of such a program looking to the strengthening and improvement of our forest-resource base. The Forest Service believes this program is soundly conceived. It provides a firm foundation for American forestry, and offers the basic action needed to build up and sustain forest productivity both for the long-term national emergency now facing us and for our permanent national welfare.

Relationships Between Military and Forest Photo Interpretation[1]

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THIS TOPIC is a timely one for consideration in at least three important respects: (1) In the event of another major war, many foresters will be called into the armed forces for the purpose of performing military photo interpretation duties, just as in World War II; (2) certain types of aerial photographic equipment and related devices recently developed for military purposes have important potential applications for forestry purposes; and (3) certain photo interpretation techniques developed either by foresters or by military personnel are mutually beneficial to both groups, thereby justifying an exchange of ideas relative to these techniques.

The Use of Foresters as Military Photo Interpreters

There are perhaps three main reasons why foresters proved to be very successful military photo interpreters in World War II and are therefore regarded as an important reserve for performing such duties in the event of another war. Because of their training and background in a scientific field, they are generally able to bring to bear the thorough, systematic, unbiased approach so necessary for solving problems in military photo interpretation. Because of their forestry experience in the construction of maps, and in some cases in the interpretation of aerial photography, they are accustomed to the vertical view of objects analogous to that from which most military photo interpretation is performed. Because of their familiarity with the ecological principles governing plant distribution, and their experience in the mapping of vegetative types, foresters are potential experts in the photo interpretation of vegetation for military purposes.

The third of these factors is of sufficient significance to merit some enlargement. There are four important ways in which vegetation may affect the conduct of military operations: (1) It may facilitate or impede the movement of foot soldiers and motorized equipment; (2) it may accentuate or conceal evidence of military activity; (3) it may affect the ease with which clearings can be made for the construction of airfields, roads, and military installations; and (4) it may serve as a source of construction material, fuel, or food. In addition, vegetative types may indicate different types of soil, drainage conditions, etc., which in turn may vitally affect the conduct of military operations. It follows that detailed information as to the type, density, and distribution of vegetation within areas of contemplated military operations is essential to the intelligent planning and execution of such operations. Aerial photographs constitute an excellent source, and for enemy-held territory frequently the only detailed source, of this vital information. In most cases the man best equipped to extract this information from aerial photographs is the forester.

Military Photo Reconnaissance Equipment Having Potential Applications in Forestry

Because of limitations imposed by military security regulations, certain specific details will be omitted in this section. As a result, several of the explanations here given are somewhat incomplete.

Shoran, a type of electronic equipment used by our armed forces for short range aerial navigation, shows promise as an aid both in the navigation of photographic flight lines (e.g., over forested areas having few visual landmarks) and in the establishment of the plan position of a photographic aircraft at the instant during which a vertical photograph is taken. The latter is significant to the forest photogrammetrist in that it may eliminate or greatly reduce the amount of costly horizontal ground control which he requires in order to map large forested areas by photogrammetric means. Once the position of the photographic aircraft is known the position (latitude and longitude) of the photograph nadir also is known, since the photograph nadir is the image of a point directly beneath the camera lens at the instant of exposure. On a truly vertical photograph, the photograph nadir is readily defined by the intersection of lines connecting opposite pairs of fiducial marks.

Gyrostabilized camera mounts.—On a photograph which is tilted as much as three degrees from the vertical (as in much of the forest photography currently being obtained) the photograph nadir may be exceedingly difficult, if not impossible, to locate without recourse to ground control points. However, gyrostabilized camera mounts of the type now being perfected by the armed forces reportedly will largely eliminate objectionable tilt from aerial photographs obtained on a vertical mapping run. Once this condition has been satisfied the photogrammetrist can locate the photograph nadir accurately and rapidly on each photograph. Thus it is seen that the employment of both shoran and gyrostabilizing equipment when photographing forested areas might radically revise present forest mapping procedures.

Long focal length cameras, which the armed forces recently have constructed, permit large scale photography of excellent quality to be obtained from very high altitudes. Recently a golf course was photographed with one such camera from an altitude of 45,000 feet. Some of the photo interpreters who examined this photography claimed they could discern individual golf balls on the green. Other photo interpreters had less fertile imag-

[1]Paper presented at a meeting of the Division of Forest Management, Society of American Foresters, Biloxi, Miss., December 14, 1951.

inations, but could clearly see individual trees and shrubs having crown diameters of less than two feet. These long focal length cameras are designed to take pictures much larger in size than the conventional 9 by 9 prints with which most foresters are familiar. At the same time, however, they have such a narrow angular field (because of their long focal lengths) that the resulting photography exhibits very little relief displacement.

The combination of photographic characteristics afforded by long focal length cameras (namely, high resolution, slight relief displacement, and large print size) should be of great interest to foresters concerned with the problem of constructing photographic mosaics in areas of high relief. For years forest photogrammetrists have been striving to lay mosaics on which areas, distances, and directions might be measured with a high order of accuracy. In forested areas of high relief, it is virtually impossible to achieve this highly desirable objective using photography taken with cameras of conventional focal length. In such areas even the employment of ratioed, rectified prints in the construction of controlled mosaics leaves much to be desired by foresters who would like to use a photo mosaic as though it were a map. Long focal length photography may provide future forest photogrammetrists with a solution to this problem.

A further possible advantage of long focal length photography to foresters lies in the fact that on such photography there is very little apparent "lean" of the trees radially outward from the photograph nadir due to relief displacement. Accordingly, very little of the forest understory and ground detail is obscured on each photograph by crowns of the overstory trees. Certain types of forest photo interpretation are thereby facilitated.

It should not be inferred from the foregoing that photography taken with cameras of long focal length would solve all problems of the forest photogrammetrist. While the reduction in relief displacement afforded by such cameras has decided advantages for some purposes there are other forestry purposes for which a large amount of relief displacement is desirable. This is especially true for problems involving the photo interpretation of height by virtue of stereoscopic parallax.

The 70 millimeter camera currently being developed by the armed forces will permit a fast-flying aircraft to obtain large scale stereoscopic coverage from very low altitudes. As such, it may eventually permit the forest photogrammetrist to obtain the very maximum of aerial photographic detail for sample strips flown over the forest. It might thereby permit him to determine individual tree species, stem diameters, tree heights, and other factors to such a high order of accuracy as to reduce greatly the amount of costly field sampling required.

There are at least two difficulties encountered in trying to obtain low altitude, large scale photography with conventional cameras of the type now being used in forest aerial reconnaissance. (1) The high angular velocity with which an image moves across the film results in image blur even when a high shutter speed is employed. This difficulty is overcome in the 70 millimeter camera by means of the so-called "image motion compensation" principle. The film in the camera actually is moving at the instant of exposure at a velocity commensurate with that of the image itself. This serves to tie the image to a given portion of the film during the exposure period, thereby minimizing image blur. (2) The small area of ground photographed on each exposure taken from a low altitude imposes the requirement for a very short interval between successive exposure. Conventional cameras cannot meet this requirement because they recycle too slowly. As a result the amount of forward lap between exposures, necessary for viewing the area stereoscopically, cannot be obtained with such cameras. This difficulty is overcome in the 70 millimeter camera by increasing the maximum recycling speed to about 30 times that of conventional cameras.

Several limitations of the continuous strip type of large scale photography pointed out by Arnold Mignery and other foresters are overcome when forest photography is flown to an equally large scale with this new camera.

Photographic flash units were used in World War II for obtaining night photography. One such unit consists of a generator, condensor, and two large light bulbs and reflectors mounted in the photographic aircraft and electrically tied in with its power plant. The large amount of electrical energy stored up within this unit during the period between successive exposures is suddenly discharged through the light bulbs at the moment the camera shutter clicks, thereby illuminating the ground during the instant of photography.

Might not this type of equipment be of potential value to foresters, not for taking photographs at night, but for increasing the amount of light reflected from shaded portions of the forest in daytime photography? If so, photo interpretation of forested areas would be greatly facilitated because of the added photographic detail discernible in shaded areas. For example, lack of detail in the shadows on conventional photography often makes it difficult for the forest photo interpreter to estimate the nature of the forest understory. It also impairs his ability to map roads, trails, and other planimetric features which may be discernible only intermittently as they wind through the forest. Lack of detail in shaded areas also renders topographic mapping of the forest by photogrammetric means very difficult in that the photogrammetrist may be unable to keep the "floating dot" of his stereoscopic plotting machine in apparent contact with the earth's surface as seen on the model. Finally, lack of detail in shaded areas makes it difficult to see the ground at, or near, the base of a tree. This impairs the forest photogrammetrist's ability to measure tree heights,

since all known methods require an ability to see the ground at or near the base of the tree.

Several other types of military photo reconnaissance equipment might be discussed if time and security regulations permitted, each having important potential applications in forestry.

At this point it would be well to ask whether the foregoing considerations are too highly theoretical in view of the increased cost of obtaining forest photography by the various means proposed.

Before assuming an affirmative answer to this question it should be pointed out that only four or five years ago it would have been unlikely to assume that an economy-minded body such as the U. S. Forest Service would ever sanction the taking of two different types of aerial photography of a forested area to serve different purposes. Yet today it is official Forest Service policy to obtain small scale photography (1/40,000 to 1/50,000) of the forest for purposes of topographic mapping and much larger scale photography for photo interpretation purposes.

Furthermore, it might be enlightening to some of us to know that only about 2 percent of the cost of preparing topographic maps is chargeable to procurement of photography, according to a recent reliable estimate made for the Rocky Mountain area. Therefore, even if the cost of procuring this photography were to increase even as much as five- or ten-fold it might not be beyond reason, when weighed in terms of the additional information thus obtained from the photographs. The additional information might be of value not only for topographic mapping, but for timber typing, engineering, and a host of other uses. If this added information were to eliminate a few costly field trips, the additional cost of procuring special photography might, at least in some cases, be considered as having been fully repaid.

These various ideas do not provide solutions to all the forester's photogrammetric problems. Commercial photo interpretation will never develop to the point where the necessity for field work is completely eliminated. But these examples should stimulate progressive thinking as to the various possibilities for obtaining better forest photography in the future. Only by careful cost analyses and other tests will it be possible to tell which of these suggestions merit selective adoption by foresters.

Photo Interpretation Techniques of Mutual Interest to Foresters and Military Men

It should be emphasized that photo interpretation entails, to a very high degree, the making of *comparisons*. In most cases the comparison is between the photographic image and the experienced interpreter's mental images plus other information in the form of maps or word descriptions of the area. In such instances, photo interpretation serves mainly to verify or deny the reliability of existing information and perhaps to refine or extend it.

In other cases the comparison is between the photographic image and some device for measuring its dimensions. The "stereo comparator" types of equipment are so called because they permit the mechanically controlled displacement of a stereo dot with the natural relief displacements of corresponding images of an object on two overlapping photographs.

Foresters, in attempting to measure tree crown diameters from aerial photographs, have found it helpful to make comparisons between the size of the tree crown image and that of a graduated series of circles each of which has been accurately drafted to a specified diameter on a transparent piece of acetate.

In instances where photographic tone may be indicative of tree species, another type of comparison may be made by the photo interpreter, using so-called "gray scale." One commonly used form of gray scale consists of a series of squares ranging progressively in tone from black to white.

In estimating the density of objects in terms of the proportion of the ground area obscured by them in the vertical view, density scales constitute helpful devices for making the necessary comparisons. In constructing one such type of scale, a series of small squares is first drawn on either white cardboard or transparent acetate. Within the successive squares progressively larger numbers of small, dark circles or blobs are randomly placed, thereby giving densities of, say, 20, 40, 60, and 80 percent, respectively, based on the total black area within the square. When comparing an area on the photograph with such a scale, the density on the photograph will be found either to match closely that of one of the squares or to be of an intermediate value which can be interpolated by comparison with the scale. Accurate density interpretation is essential in making crown closure estimates from aerial photos of the forest. It is similarly important to the military photo interpreter in making estimates of the density of buildings in an urban area and in various other phases of military interpretation.

One type of comparison of great potential value to both military and forest photo interpreters is that involving the use of a photo interpretation key.

Those familiar with taxonomy as applied to the biological sciences know the great value of keys for identifying the various orders, families, genera, and species of plants and animals. Such keys, or "word descriptions," are so arranged as to set forth in systematic fashion the unique characteristics which are useful in distinguishing each type of organism from similar, associated types. Keys have also been used with varying degrees of success in many other sciences including mineralogy, crystallography, ecology, and more recently —photographic interpretation.

A photo interpretation key is a device designed to aid photo interpreters in the rapid and accurate identification of objects from a study of their photographic images. The key may assume any number of forms but ideally should provide two things: (1) a word

description of the salient recognition features for each object in the key; and (2) photographs illustrating each of these features.

The word description alone usually is insufficient, for it may convey different impressions to different users of the key. Typical of this limitation is the following word description used in one recently-published photo interpretation key to describe the appearance of a logged, deciduous forest: "..... looks like ground fatty meat that has been poorly mixed." If a photographic illustration were to accompany this word description it might be very meaningful; but in this case no photographs were used, with the result that the words alone conveyed vastly different impressions to different readers.

Similarly the photographic illustration alone is often inadequate, for without a word description the interpreter's attention is not directed specifically to those salient features most useful in photo identification of the object in question.

The value of a photographic interpretation key, whether it be for military or forestry purposes, usually is two-fold: (1) It serves as a training aid for teaching photo interpreters to recognize objects with which they have had little or no previous interpretation experience; and (2) it serves as a photo image reference file which the trained interpreter can consult periodically to ascertain whether he is still interpreting certain types of photographic images correctly. These values of the key are so great that it is deemed appropriate to present here a specific photo interpretation key of the type useful to foresters as well as to military photo interpreters. Although this type of key is by no means the only usable type, it should serve as a helpful guide to the construction of similar keys for various other "populations" which are to be classified and identified by photo interpretation.

The population under consideration in this particular key is wild vegetation of the tropical Pacific area. One reason for using this example is that photo identification of vegetation in the tropical Pacific area poses perhaps as great a problem as anywhere in the world because of the tremendous variety of species and the luxuriousness of the plant growth there.

In the preparation of this or any other key, one of the first important steps is to define the exact purpose to be served by the information derived through photographic interpretation. For example, there obviously would be no point in trying to devise a photo interpretation key to every plant species in the tropical Pacific (assuming for the moment that this were possible) unless some use were foreseen for this detailed information. Certain species of the tropical Pacific such as mangroves, casuarinas, nipa palms, sago palms, wild sugar cane, etc. may merit individual identification either because of their economic importance from the forestry standpoint or because of their reliability as indicators of soil types, drainage conditions, insect or animal populations, hazards to travel, etc. Other species may be conveniently lumped into much broader vegetation types; for example, the individual species comprising a moss forest, rainforest, swamp forest, savannah, etc. may be of little interest to the user, whereas the location and distribution of these broader types may interest him greatly. There may be a third group of plant species which are of little significance to the study except as they facilitate or impede the movement of exploratory field crews. These species may be lumped still differently; for example, it may be both necessary and sufficient to interpret grass stands simply as tall grass or short grass depending on whether or not the stand grows taller than a man and thereby obstructs appreciably both his vision and his movement through it.

Assuming that in our example all the foregoing considerations are of importance, it may be decided to subdivide the wild vegetation of the tropical Pacific area into, say, twelve types (as will presently be shown) each of which is normally identifiable on aerial photographs.

Since, in all probability the photo interpretation is to be done mainly from stereoscopic pairs of vertical aerial photographs, taken at scales of from 1/10,000 to 1/15,000 with panchromatic film and a minus-blue filter, care is taken to select one or more stereograms of each vegetation type which will be representative in all the above respects.[2]

Next, the salient photo recognition features of each of the wild vegetation types are noted, such as size, shape, pattern, tone, texture, shadow, and site. Once this has been done, the same format used in a dichotomous ("two-branched") botanical key is employed; for example, a single photo characteristic is sought which will distinguish all wild vegetation from all cultivated vegetation, another which will subdivide all the wild vegetation into two broad groups, still another which will segregate all vegetative types of a group into two subgroups, and so on until all the individual types to be identified have been keyed out in this dichotomous fashion. Usually at each step in the breakdown, except the last one, only one or two clear-cut characteristics are used for making the separation. At the last step, however, where the individual type is to be keyed out, it is desirable to describe this type as fully as possible, giving special emphasis to a listing of all the possible contrasting characteristics between it and some other closely related vegetation with which it might be confused.

The product of all the effort described in the preceding paragraph should be a dichotomous key, of the type shown on the next page.

In using this key to identify any particular vegetation type, the photo interpreter always starts at the top of the key; reads the first contrasting characteristic; interp-

[2]These photographic illustrations, constituting a vital part of the key, were presented at the meeting by means of lantern slides, but are omitted here because of space limitations. The reader who is interested in seeing the illustrations is referred to a publication of the U. S. Naval Photographic Interpretation Center entitled "Pacific Landforms and Vegetation."

KEY FOR THE IDENTIFICATION OF WILD VEGETATION TYPES IN THE TROPICAL PACIFIC AREA

A	Plants growing in swampy or poorly drained sites; subject to flooding.	See B
A	Plants growing in well drained sites, rarely or never subject to flooding.	See F
B	Plants with palm frond leaves.	See C
B	Plants without palm frond leaves.	See D
C	Leaves light in tone; rarely in distinct rosettes; all plants in clump of uniform height (about 10 ft.); without distinct flower stalks. Usually grow in compact stands along stream banks near coast with roots submerged in brackish water.	Nipa
C	Leaves dark in tone; in distinct rosettes; plants in same clump usually of variable height (10-30 ft.). Conspicuous white flower stalk frequently protrudes above center of rosette. Usually grow in rather open stands in areas subject to periodic flooding by fresh water.	Sago
D	Grass of uniformly grey tone and with "velvety" texture resembling sugar cane; usually confined to stream banks.	Wild Cane
D	Trees of variable tone and texture.	See E
E	Trees usually dark in tone, with uniform height of 20 to 40 feet; confined to muddy coastal fringes and stream banks inland to the limits of brackish water.	Mangrove
E	Trees of mottled tone and variable heights up to 150 feet; often bounded on the seaward side by mangrove and on the landward side by rainforest.	Swamp Forest
F	Grass of uniformly grey tone and very fine texture.	See G
F	Plants of mottled tone and coarse texture.	See H
G	Grass from 4 to 12 feet high; on moist level sites	Tall Grass
G	Grass from 1 to 4 feet high, on well drained, rolling to steep terrain.	Short Grass
H	Bushes and trees (20 feet or less in height) densely entangled by vines; ordinarily confined to areas that have been cleared of jungle in recent years by man, fire, landslides, etc., and left to revert back to the jungle climax vegetation. Usually bounded by jungle hardwoods on at least one side.	Secondary Growth
H	Trees 50 feet or more in height.	See I
I	Trees resembling pine with narrow, pointed crown and long slender stem extending nearly to top of tree. These features frequently discernible from shadow cast on light-toned sandy beach to which tree is usually confined; crowns of trees have a light grey tone in aerial photos.	Casuarina
I	Trees with broad, rounded crown and much-branched stem.	See J
J	Trees widely spaced, with grass-covered ground readily apparent between them; confined to dry areas.	Savannah
J	Trees densely spaced, with bushes and vines, instead of grass, constituting the understory; confined to humid areas.	See K
K	Trees normally confined in tropics to altitudes of 4,000 to 11,000 feet. Light in tone because of light reflected from dense growth of moss and lichen on branches and ground. Tallest trees usually less than 100 feet high.	Moss Forest
K	Trees ranging from sea level to an altitude of about 6,000 feet. Mottled in tone, being composed of many species of trees which almost invariably grow in mixed stands. Tallest trees 150 feet high or more.	See L
L	Dense undergrowth beneath trees; crown canopy of trees usually of variable height with frequent small openings where direct sunlight can strike ground. Common on steep slopes, along stream banks and at edge of clearings.	Rain Forest with undergrowth
L	Very little undergrowth beneath trees; largest trees form almost continuous crown canopy which permits little or no direct sunlight to strike the forest floor.	Rain Forest

rets this characteristic on the photographs for the vegetation type in question; chooses one branch of the key or the other on the basis of his interpretation; and proceeds on down the key until the name of the vegetation type appears opposite its detailed description. Consistent with what was previously stated, it will be noted, for example, that at the final breakdown in the key between sago and nipa palm (Step C), all diagnostic characters of these two species not previously listed are arranged as pairs of contrasting characteristics. Accordingly, if positive identification would have been doubtful on the basis of one particular characteristic (such as photographic tone) a sufficiently large number of other characteristics are available that no doubt would remain as to which of the two species is present within the area in question on the aerial photographs. Comparison of the vegetation to be identified with the photographic half of the key (here omitted) should offer additional evidence of the correctness of the interpretation.

The key which has just been presented greatly facilitated the training of military photo interpreters during World War II. It also served as a valuable reference file for field use. The facts above would seem to suggest that such keys should be used much more extensively both in military and forest photo interpretation.

Returning to our previous analogy, the taxonomist who is attempting to classify a group of organisms, first discovers the identifying characteristics of each species and then systematically sets forth these characteristics in the form of a key. Once a photo interpreter has learned to recognize various objects from their photographic images, he likewise might do well to set forth their identifying characteristics in systematic key form. It took Linnaeus, Bessey, and other taxonomists several centuries to convince their colleagues that a key is the best way in which to set forth facts having

diagnostic value in the identification of objects. It is encouraging to see that both military and forest photo interpreters are fast recognizing a large number of their problems to be taxonomic ones also and are considering keys as possible solutions to those problems.

In concluding this rather optimistic discussion, a cautious note should, perhaps, be sounded. Recently the enthusiasm for photo interpretation on the part of both foresters and military men has gone considerably out of bounds in certain instances. Those having little or no previous experience at working with aerial photographs have been led to expect too much information to come directly from the photographs rather than from the ground study or from other sources. In addition, some of these men have known too little of how to extract from the photographs such information as is available. Their high hopes and initial failures in the use of aerial photographs have in some cases resulted in such bitter disillusionment that they have abandoned further consideration of aerial photography as a useful tool.

To avoid recurrence of this misfortune, a clear understanding is needed of both the advantages and limitations of photo interpretation; an understanding also is needed of possible ways for overcoming some of the limitations by means such as have just been discussed. With the sound judgment that comes from such an understanding, photographic interpretation can look forward at mid-century to an ever-broadening horizon in both forestry and military fields.

Importance of Hardwood Utilization Trends in Southern Forestry[1]

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WOOD IS A VERY IMPORTANT ITEM in the economy of our nation, and its importance will continue in spite of competitive materials. The use of wood and forest products will increase rather than decrease in importance in our national economy, for research in wood and its products is in its infancy.

Wood is a great vital renewable resource and, although as a nation we have been a little slow in the recognition of this fact, timber has at last become recognized as a crop. The growing "tree farm" movement, which currently involves some 25 million acres—an area almost as great as my own state of Kentucky—is evidence enough that large and small land owners have confidence in the future of wood.

It is important that the foresters of this nation, as well as those who use the products of the forests, do not fail to recognize the public trust that is placed upon us, the responsibility to the nation and the generations to come to maintain in our country an adequate wood supply.

In a world in which there exists an estimated potential ten billion acres of accessible forest lands, it is difficult to conceive of any wood shortage in the foreseeable future. The Western Hemisphere alone, including the United States, has an estimated 3,700,000,000 acres of timberlands.

There are, however, vast areas of the world in which a wood shortage actually exists. Our problem is to bring balance between growth and drain, within our own continental boundaries. It is our job to see that, as a nation, we become self-sufficient in so far as our own needs for wood are concerned.

In talking about hardwoods—southern hardwoods—I would like to include, as a part of the South, Kentucky, Tennessee, and West Virginia. In this area, according to the 1945 estimate of the U. S. Forest Service, lies a total of 205 million acres of forest land. Of this vast acreage, 187 million acres are privately owned. It is also noteworthy that farm ownership comprises 41.5 percent of private timberlands and 38.5 percent of the total timberlands of this region.

This area contains an estimated stand of 359 billion board feet of saw timber of which only 13 billion can be classified "old growth." Three hundred and forty-six billion board feet is second growth saw timber, and of this 163 billion feet, or 45.5 percent of the total stand in the region, is hardwood.

It is this 163 billion feet and the species it comprises that I am discussing. Thirty-seven percent consists of various species of oaks; 18 percent sweet gum; 13 percent tupelo and black gum; 7 percent yellow poplar; 3 percent birch, beech, and maple; and 22 percent of the lesser species, such as elm, hickory, ash, cottonwood, willow, and others.

The most significant and outstanding fact of the figures just given is that 96.5 percent of the saw timber of the South is second growth. Is there a better demonstration anywhere on earth that timber is a crop? It is proof positive that this great area of our country, from the Mason-Dixon Line south and from the Mississippi Valley to the Atlantic Ocean, is the timber garden of our nation.

If new growth were estimated at 200 board feet per acre a year, this area alone would develop almost enough saw timber to supply the current national demand for boards. Under intensive and proper forestry practices average growth of 200 feet can be accomplished or exceeded.

The last ten years have indicated the degree to which progress can be made by an enlightened forest products industry. Great steps have been taken in the encourage-

[1]Paper presented at the 51st annual meeting, Society of American Foresters, Biloxi, Miss., December 13, 1951.

ment of owners of small timber tracts to give them a better understanding of the benefits that can accrue to them by better timber management.

In this area 41.5 percent of the privately held timber is in farm wood lot ownership. It is this timber that must be properly "cropped" and properly merchandised if "tree farming" is to be ultimately successful. Some farsighted and forward looking policies need to be established, and soon, for it is this farm wood lot timber which will provide the ultimate balance between growth and drain in supplying not only the needs of the South but in contributing its portion to national needs as well.

In many ways it is a very satisfying picture, but let us not make the serious mistake of confusing quantity with quality.

The current military preparedness program has awakened some of those in the forest products industries to the need for more adequate figures on quality. We must translate our hardwood timber resources into terms of species, quantity, and quality.

What is going on in these second-growth hardwood stands of the South? How good is this timber? What are we taking? What are we leaving?

You will not be happy with the facts, especially if you are concerned with requirements calling for high grade logs for veneer or lumber.

The Southern Forest Experiment Station has two releases—No. 66 *Mississippi Timber Stands Before and After Cutting*, and No. 67 *Arkansas Timber Stands Before and After Cutting*. These releases should be a *reading must*, for they are the first studies that I have seen that give an answer to the all-important questions in regard to quality.

Better utilization of our timber resources is the main highway to conservation. My subject is "the trend of hardwood utilization in the South." A trend can best be defined as a deviation from a course or direction. A trend, therefore, is historic; it is the plotted course resulting from pressures, events, or decisions that cause changing of a given course or direction.

In industry, trends are created by the decisions and thinking of men. Trends, therefore, can be controlled or guided.

People see what they are taught to see and think what they are taught to think. The time is here for strong leadership to come forward. The time has come to analyze coldly the facts about the forest resources of not only the South but of our entire nation as well. We must know more about quality. We cannot continue to judge our timber resources by volume alone.

To do this job all segments of the forest products industry must join in a united effort. Industry and government must cooperate in order that a sound, farsighted program may be evolved.

For the sake of our nation, let us show our patriotism and our selflessness. Let us recognize the true force that lies within the free enterprise system — a force that has made our nation rise to heights of prosperity and leadership never before attained in history. What must be done can be accomplished by leadership and direction to a greater degree than can be accomplished by regulation.

I would like to suggest that the Society of American Foresters, at this meeting, take such action as may be necessary to bring together a small group from all segments of the wood-using industries, state and federal agencies, and such others as they may deem necessary in order that the problem of wood supply may be studied and industrial needs coordinated. We by our own action, can establish a trend. No one group of people anywhere is better equipped to understand and cope with this problem than the foresters of this nation. Only by freedom of action can we plan and guide these trends.

It is my feeling that at the present time the entire forest products industry of the south is in a state of flux. A transition has taken place, first, in gradual conversion from old to second growth timber, with all the utilization problems this has involved; second, has been the impact of a rapidly developing pulping industry; third, new products, processes, and mechanical developments resulting from research, which are changing old concepts of conversion methods and markets.

Time will not permit discussion at length of each of these problems and their effect on utilization. The problem of low grade lumber is a current and increasing problem. We are all familiar with it. It is a result of the quality of the timber. There are answers to this problem.

We know, or should know, that we cannot go on sawing logs into boards for which there is no market. The continuing decline in grade out-turn should indicate the urgent need for better determination of the type of logs that will go to the saw mill. It costs money to make and carry in inventory the boards from low grade logs. Will they pay their way? Perhaps these logs belong in a different product. Their proper use will greatly improve the over-all utility from our timber and bring growth and drain closer together.

The increase in the use of hardwoods for pulp is well known. Dr. Stevenson of the American Pulp and Paper Association advises me that 461,000 cords of mixed hardwoods were pulped in the south in 1950, and the 1951 consumption for the first 8 months has already exceeded the 1950 total.

New products, new processes—what are they? Their number is legion and we have only started. Laminated timber — making big ones out of little ones, and making them in curved or flat section—has been born from the necessity of war requirements. From this process has come a new structural material—an engineered material, if you wish—the conversion of small trees into a material that will compete with steel. Laminates permit the combination of the best mechanical properties of each species of timber into a structural

unit. The timber can be preservatively treated before gluing to give high resistance to decay.

Molasses for cattle feed, soil improvers, and an endless number of products are possible from material that used to go to the burner.

New types of saws, new methods of machining—all these are pouring down on the heads of the primary and secondary converters, on the heads of an industry that is historically non-technical in its approach to its problems. It is coming faster than the industry can digest it. The industry is not technically prepared.

If we are going to develop or guide a trend, we are going to do so by seeing and thinking of trees in terms of end products. Again, I say, "people see what they are taught to see and think what they are taught to think."

We can no longer see trees in terms of boards, or veneers, or poles, or ties, or pulpwood. We must see in these trees their potential end products. We must stop thinking in terms of a particular method of primary conversion and think in terms of markets. We must think not in terms of feet per acre but in terms of dollars of products per acre, the innumerable and endless products for which wood is, or can become, the basic raw material.

If we want to start now to obtain the utilization of our timber resources that we in the South should obtain, every owner of timber should see that the trees he takes from the forest go into the products for which those trees are best suited. This is truly an ambitious program, but under proper education and leadership it could be started on the road to accomplishment.

To classify trees in terms of end products will require a new and highly specialized field in professional forestry. It calls for a "forest marketeer."

What are the qualifications of such a man? They are unusual. He must know timber, he must know intimately all the problems and methods of primary conversion, and he must know markets and the current condition of those markets.

It is this man's job to mark trees, or portions of them, for end use, to see that they are properly channeled to markets. This marking for end use is currently being done at some highly integrated operations. It should and can be a general practice. To train such people is a responsibility of this Society.

By this method, it is conceivable that the highest utilization can currently be obtained from every tree removed from the forest.

We cannot continue to convert trees indiscriminately into lumber, or veneer, or other primary products without taking into account the market for the products so produced.

High labor costs and conversion costs into secondary products tend to restrict the marketability of primary forest products of low grade. Costs place a tremendous pressure on the manufacturer of end products using wood to search for substitute materials.

By our own shortsightedness we can destroy our own markets. To save them we must study and analyze them. Certain species of hardwood lumber have ready markets for all grades, others do not. Sweet or sap gum is a good illustration of a species with a very limited market for grades of No. 2 Common and below. It represents a high proportion of the total available species of the region. Gum is a species that should be carefully selected for end use. Why make products you cannot sell at a profit? Why make lumber from logs that will produce 60 percent or more of No. 2 and No. 3 Common boards? Neither will these logs make a salable veneer product. Is it not better to send these logs to the pulp mill?

Certain species of oak are in this same category. So are other hardwood species.

Wood has been the traditional material for the housing of the people of our nation. It is my certain feeling that it will continue to be so. The home building market has been a major market for the softwoods. Hardwoods are going to play an increasing part in this market. Hardwoods in the form of pulped products—paper products, if you will—products that in the making will have become fire resistant.

If there is any indication of a trend discernible in hardwood utilization in the south, I would say that it is in the rapid advance of hardwood pulping.

Investigatory work has been done on practically all hardwood species. Blackjack oak, chestnut oak, hickory, and other so-called refractory woods are producing high yields by both sulphite and sulphate semi-chemical processes. These are producing pulps and papers suitable for a wide variety of uses.

This is going to provide the market for the low grade timber and much of the so-called "wood waste" of the tree farm of tomorrow as well as the tree farm of today.

I keep returning to the tree farm—to the 41½ percent of our forested area in farm wood lots. I keep doing this because I feel strongly that much guidance is going to be necessary here. This growing of trees for profit is not like growing an annual crop of corn, or cotton, or wheat. It is a long-term venture. It will only produce the crop necessary to meet the requirements of the nation for wood in all forms—veneer, boards, timber, and pulp—if it is a planned crop. That means that it must be planned on a long-term basis with eventual markets in mind. There is too little planning today. Too much timber is being cut, unselectively, too soon. The addition of a very few more years of growth could add many dollars to the owner's pocket. There is too much temptation to cut too soon. It is just as tragic to send a saw or a veneer log to the pulp mill as it is to try and make merchantable veneer or lumber from a pulp log.

There is a sure and quick answer to this problem. That is education. People see what they are taught to see. There must be more information on good forestry practices placed in the hands of the tree farmers and farm wood-lot owners.

As much information as is made available on livestock or on crops.

We must enlist more of our farm wood-lot timber in the "tree farm" movement. We must get this timber under management. The growth of the "tree farm" movement has been significant and the twenty-five million acres already enlisted represents a magnificent accomplishment considering the short period of time in which this movement has been under way.

We need not worry about the larger private holdings of timber. For the most part, this type of ownership is fully aware of their opportunities as growers and converters of forest products.

I believe sincerely that a strong marketing organization is needed to dispose of the product of the small timber tract. This could well serve a dual purpose of assisting in management as well as marketing. It could even serve as a concentration point within its area for the collection, storage, and distribution of timber products if no existing facilities were available.

We call timber a crop. If it is to be a cash crop, we must provide a ready cash market for it. To provide this kind of a market is a responsibility of industry and industry must accept it.

A farmer may take one hog or fifty to the stockyards and sell for cash. He may take his corn to the elevator, his cotton to a gin, but where, pray tell me, can he take one tree. Before the "tree farm" movement gets much older, we had better begin to think of this one. We must devise a method of properly channeling each tree to its proper market be it one or many. We must be sure that the dollar yield of the "tree farm" is as high as possible. The dollar incentive is the greatest incentive that I can think of to make a tree farmer take a real interest in growing better timber, in taking care of what he has—of stand improvement.

In order to accomplish proper classification of trees for markets, the first step is the thorough establishment of log grades. Much work has already been done on this. Better utilization will result from the primary conversion of graded logs. Industry has been slow to recognize this, but with increasing conversion costs they will find that the peeling or sawing of graded logs will permit pre-determination of product grade out-turn and thus give them manufacturing costs that can be controlled. The work done by the Forest Products Laboratory on log grades represents a practical set of grades. In my opinion, at least it is a point from which we can start. Log grades are as essential as lumber grades, or veneer grades, or tie grades.

The farmer is use to selling graded farm products. He will want to sell his logs this way, and he should be able to dispose of them this way. I have had enough experience buying and sawing logs on grade to know that it is thoroughly practical.

We must see that grades for logs become as standard as grades for lumber. The establishment of log grades for hardwood logs should be undertaken by the National Hardwood Lumber Association as soon as practical.

If we are going to do the job of better utilization of timber resources that must be done, we must spend time and money on better methods of bark removal.

This problem is largely the problem of existing lumber, veneer, and pulp mills. Whether it is done chemically or mechanically in so far as the saw and veneer mills are concerned, the primary conversion of previously barked logs opens up a vast market for the by-products of this type of conversion. This by-product material in the form of slabs, edgings, veneer cores, and clipper waste can all be chipped for pulp. The days of the burner should be numbered. This practice of debarking has already become established in many of the larger units in the lumber industry. In my opinion, the conversion of previously de-barked logs will soon become standard procedure in most mills of reasonable size.

Convert this salvageable material back into trees in terms of cubic feet, board feet, cords, tons, or any other unit of measure and the amount is staggering. Don't let it disturb you. The more of this we use—the higher the yield from each acre—the sooner it becomes profitable to let little trees grow bigger. Let them be the trees of tomorrow.

The pulp and paper industry are naturally concerned about sources of raw material. They own vast timber holdings. They do, however, still import a large tonnage of pulp. The tonnage of pulp production in our country has increased from three hundred and thirty thousand short tons in 1925 to one million two hundred and thirty one thousand short tons in 1950 — a growth of almost 400 percent. In addition, the industry imported one hundred and ninety-eight thousand tons in 1950. The needs for the pulp industry are growing. This increase in demand for wood pulp can be met by better utilization of timber by saw and veneer mills.

I have said strong leadership is essential. I have said cooperation of all interests is necessary—timber owners — industry and state and federal governments. If this can be brought about, a definite trend—a guided trend—to better timber utilization can be brought about in the South.

I feel that the Society of American Foresters can provide the melting pot into which all phases of this problem can be gathered and from which can come forth a program — a plan — that will bring about the utilization of our timber so necessary to our national well-being.

Highlights of Forest Grazing Research in the Southeast[1]

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SINCE 1940 three bureaus of the U. S. Department of Agriculture,[2] together with state agencies, have been cooperating in forest grazing research in North Carolina and Georgia. Most of the research has been carried on in the Coastal Plain region, where the possibilities are high for successfully combining the production of cattle and timber.

Mountain and Piedmont Forests

In mountain hardwood forests grazing is seldom justified. Forage values are relatively low and the chances of damaging timber, soil, and watershed values are very great. This has been brought out in studies at the Coweeta Hydrologic Laboratory, where heavy grazing of an experimental watershed eliminated desirable tree reproduction, increased runoff and erosion as a result of changes in physical properties of the soil, and reduced the growth rate of the remaining trees (*6*).

Piedmont forests, too, have only moderate grazing values. Exploratory grazing studies in Piedmont pine types have been conducted near Raleigh, N. C. by the forestry school at North Carolina State College (*7*). In these forests, the forage is adequate for two or three months in the spring, but cannot be relied upon as the major source of forage for a beef cattle enterprise. Grazing is not recommended where hardwood reproduction is desired, because some of the best hardwood species, such as yellow-poplar and ash, are palatable to cattle. On the other hand, grazing might be applied for fire control and as a silvicultural measure to help control vines and hardwood sprouts during regeneration of pine stands. Cattle relish honeysuckle and will browse some of the less valuable hardwoods such as black gum, sassafras, and sourwood. Pine foliage, in general, is not palatable.

Coastal Plain Forests

In view of the limitations in the Piedmont and mountains, it is apparent that the Coastal Plain pine lands, with abundant herbage and minimum erosion hazards, offer the greatest possibilities for a successful integration of cattle raising and timber production in the Southeast. Here forest grazing research is now largely concentrated in the cane type, which is the most productive forage type in the region, and in the "wiregrass" type, which is the most extensive.

Cane (*Arundinaria*) was once widespread throughout the Southeast, but extensive stands of this species are now confined largely to swamplands of the Carolinas and to the bottomlands of the Mississippi Delta (*9*). In the Carolina Coastal Plain, it occurs with lowland hardwoods and loblolly pine, but the most extensive stands are associated with pond pine in areas which have burned periodically throughout the historical period.

The value of cane forage has now been well established through experimentation. In non-timbered canebrakes on the drained and burned site of a former lowland mixed-hardwood forest in eastern North Carolina, experimental breeding herds thrived on vigorous cane range from May to January with no supplemental feed except minerals (Fig. 1). Calf crops have averaged between 80 and 90 percent, with calves weighing 350 to 400 pounds when weaned at about 8 months of age (*1, 5*). Stocked at the rate of 2½ to 3 acres per cow and calf for 7 months, this range has produced a sustained yield of 120 to 130 pounds of beef gain per acre annually. In addition to the beef produced, grazing has been of distinct value for reducing the high fire hazard of this area. Compared to ungrazed cane, fuel was reduced by half under proper stocking, and up to 70 percent on overgrazed ranges. Actual inflammability, though not measured, was undoubtedly reduced even more. The results from this cane area indicate that it ranks among the highest yielding native ranges in the United States. It is also better than the average of the cane type in the region.

On poorer sites both the quantity and quality of forage is lower, and the cane is often intermixed with shrubs. Relationships between grazing and forest management were studied for 6 years in such cane range at Hofmann Forest in eastern North Carolina (*8*). Here, 12 to 15 acres per cow were needed for an 8-month summer season or a 4-month winter season (Fig. 2). The grazing not only decreased fire hazards materially, but also encouraged pine regeneration. Pine seedling establishment was increased five-fold by grazing on unburned areas, and 50 percent on areas recently burned. The growth rate of small pine seedlings was also increased 7 to 67 percent, depending on their relative sizes. On the other hand, mortality of seedlings less than a foot tall was 10 to 15 percent higher under grazing. For seedlings over 3 feet tall, no grazing influence could be detected.

In this study, logging had little influence on grazing values or pine reproduction. Fire, however, had a great influence, as revealed by an evaluation of the effects of three wildfires which burned parts of the experimental area. Fire seems to be essential for regenerating pond pine stands, for only on burns was satisfactory reproduction obtained. Burning also favored cane in competition with shrubs when grazing was controlled. But heavy grazing following fire, practically eliminated the cane stand. Detailed prescriptions for using fire in the management of cane or pond pine have yet to be worked out.

Cane has proved to be highly

[1]Paper presented at a meeting of the Division of Range Management, Society of American Foresters, Biloxi, Miss., December 14, 1951.

[2]The Forest Service, the Bureau of Animal Industry, and the Bureau of Plant Industry, Soils and Agricultural Engineering.

Fig. 1.—Cane produces high quality forage on good sites but it requires careful management. The cane stand shown here has been weakened by overgrazing.

Fig. 2.—Forage values were mediocre in this relatively poor cane site. However, grazing increased the establishment and growth rates of pine seedlings and decreased the fire hazard.

vulnerable to misuse, but progress is being made toward a better understanding of its growth habits and requirements. Studies of available carbohydrates in the rhizomes and stems have revealed great seasonal fluctuations in food reserves, minimum levels occurring in May or June and maximum levels in September or October, at which time a reasonably good cane stand has well over a ton of starch and sugar per acre stored underground. Most of the annual foliage production occurs during early summer regardless of utilization, and heavy defoliation during June or July reduces food reserves and plant vigor more than at any other time. A tree canopy reduces the quantity of forage, but apparently not the quality as indicated by protein and mineral content. In fact, a tree canopy is essential on winter range, for under trees about half of the cane foliage remains green and palatable all winter. Complete defoliation in winter does not appear to be harmful, and up to 60 percent utilization during the summer season has maintained a productive cane stand. Grazing can be deferred until late summer without sacrificing forage quality or cattle gains (*2*). With such information, grazing systems adapted to the growth habits of cane have been developed and are being tested with six herds and twelve ranges at the Frying Pan Experimental Forest Range, a recently established work center in eastern North Carolina.

As a further aid to proper management of cane range, criteria are being developed for estimating grazing capacity with reasonable accuracy by survey methods. Of various plant measures investigated for 3 years on 20 test ranges, grazing capacity was found to be most highly correlated with cane height and foliage density, and with number and size of stems per unit area. It was interesting to find that with only 4 hours of training, a group of men were able to estimate average foliage density (a rather subjective measure) more consistently than they could estimate the average number of cane stems per square yard—the relative range in values for the two measures being similar.

An exploratory study of pasture firebreaks in pond pine forests has aroused as much public interest as any aspect of grazing work in North Carolina, with the possible exception of the Brahman and Africander cattle being tested in the range herds. Experimental firebreaks, ditched and crowned to avoid flooding, were successfully constructed using combinations of such implements as a Mathis fireplow, a bush-and-bog harrow, a Marden brush chopper, and a road grader, and were seeded to various pasture species and mixtures. Inflammability tests during a very dry period 2 years after establishment indicated that grazed pasture sods can be very effective firebreaks. For this use, Ladino white clover, big trefoil, Dallisgrass, and Alta fescue are among the species showing most promise in North Carolina.

Although cane is outstanding from the viewpoint of forage quality, wiregrass is of greater importance on the Coastal Plain ranges because of its wide extent. The wiregrass forage type extends from North Carolina to Alabama but is most extensive in the longleaf-slash pine flatwoods of Georgia and Florida (*1*). Federally sponsored grazing research in this type is now concentrated near Tifton, Ga., in cooperation with the Georgia Coastal Plain Experiment Station.

Low quality forage has long been recognized as a limiting factor of cattle production in the wiregrass type (Fig. 3), and burning for forage improvement is a common practice (*3*). The effects of burning annually and at 2 and 3 year intervals were studied for 7 years at the Alapaha Experimental Range. Winter burning greatly increased the protein and the mineral content of native grasses until they reached the full leaf stage of growth. Thereafter, forage quality on burned and unburned range was quite similar. Cattle gains were three times higher on burned range during the spring, and since most of the total gain had been made by July, approximately the same advantage over unburned range was maintained until the end of the grazing period in October or January. Burning alone had little influence on the density of native forage species, but burning

combined with heavy grazing reduced the density of bunchgrasses and favored the invasion of low-growing species such as carpetgrass. Since carpetgrass furnishes better summer grazing than do the native bunchgrasses, the trend toward carpetgrass appears to be desirable until a balance is reached between spring and summer forage. Periodic burning was somewhat better than annual burning from the grazing viewpoint. None of the burning cycles tested permitted regeneration of slash pine.

A 5-year study with four breeding herds pointed up the value and limitations of wiregrass range for cattle production. A 50 percent calf crop, with calves weaning at 250 to 300 pounds, appears to be all that can be expected of herds maintained essentially yearlong on wiregrass range. Apparently the quality of wiregrass forage is not high enough to satisfy the requirements of a lactating cow. Cows with calves made only slight gains in early spring, barely maintained their weight during the breeding season (May and June), lost weight the remainder of the grazing season, and usually failed to calve the next year. When not nursing calves, the cows gained weight rapidly in spring, continued to gain slightly through the summer, and usually calved the following spring. Supplemental protein feed during the fall and winter, and drylot feeding for 6 weeks in late winter, decreased death losses and increased the weight of cows and calves but did not significantly affect the percentage calf crop.

During February and early March, when new growth was developing in burned ranges, 3 or 4 acres of separate unburned range per cow adequately replaced 1,100 pounds of chopped sugarcane, which cost about $2.25, in the feedlot.

So-called "native" cows in the herds produced larger calves at low-nutritional levels than did grade Herefords, but there was no appreciable difference in the calving percentage of the two types of cattle. Brahman breeding has been introduced as a possible means of increasing herd productivity but it is apparent that any substantial improvement must come through nutrition.

To raise the level of nutrition of range cattle in wiregrass country, three approaches are being tried: (1) feeding protein supplement in summer as well as winter, (2) integrating the use of improved pasture with native range, and (3) introducing improved forage species into the range.

The increased calf gains obtained —approximately 75 pounds per head—will apparently pay for supplementing the herd with a pound or so of protein meal per head daily through the summer (Fig. 4). The increase in calving percentage resulting from this practice appears to be appreciable but it has not yet been fully evaluated.

Efficient integration of pastures and range in the wiregrass region, where improved pasture is limited and costly but native range is abundant and cheap, involves the maximum use of range consistent with acceptable cattle production. Three possibilities for combining range and pasture from March to November are being tested with breeding herds: (1) range alone until July 1 and pasture alone thereafter, (2) range alone until July 1 and range plus limited pasture threafter, and (3) range plus limited pasture seasonlong. The study has only begun, but the performance of cows and calves the first year indicates promising possibilities for supplementing range with improved pasture. The first crop of calves from these herds were 100 to 170 pounds heavier at weaning than were calves from herds using range only.

Many forage species have been tested for "reseeding" or "revegetating" wiregrass range, and practical establishment procedures have been demonstrated. Although fertility requirements vary considerably, some fertilization has been necessary for all introduced species offering any appreciable improvement over the native forage. Legumes have been successfully established by merely broadcasting the seed and fertilizer on freshly burned range and grazing the native regrowth heavily. For introducing grasses, disking or chopping the native sod has proved

FIG. 3.—Low quality forage limits the productivity of range herds in the wiregrass region.

FIG. 4.—These calves, from cows on wiregrass range supplemented with protein meal, averaged 360 pounds at 8 months—75 pounds more than calves from unsupplemented herds, but 30 to 100 pounds less than those from herds using both range and improved pasture.

beneficial, and some such treatment is often desirable for brush control. The economies of range revegetation is being investigated through studies of grazing capacity and cattle performance under different levels of improvement—as regards fertilization, species, and brush control practices. Profitable returns are indicated by the first year's results, where gains of yearling heifers averaged 215 pounds per head and up to 180 pounds per acre under "high-level" improvement, and around 160 pounds per head and up to 100 pounds per acre under "low-level" improvement. At current cattle prices, the value of the first year's gains usually exceed the range improvement costs.

The ultimate objective of range research in the Southeast is to determine how the grazing resource can best be used to increase the total productivity of forest land for maximum benefit to the landowner and to the community. The initial phase has dealt primarily with problems of forage and cattle management. Soon we hope to have experiments that actually integrate grazing and timber management. We want to find the maximum possible return from beef and timber growing, and how each operation can be made to assist the other. There have been cattle in the piney woods forests ever since the time of the Spaniards. Spanish rule did not last, but the cattle are apparently here to stay.

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Harnessing Farm Woodlands and Southern Industry[1]

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IF THE JOB of harnessing 62 million acres of southern farm woodlands and southern industry were confined to forestry, it would be a relatively simple subject for discussion. While the South still has far to go in solving all its silvicultural problems, foresters are farther along this field than they are in the field of human relations. The major hurdles to cooperative effort between the farm woodland owner of the South and industry are outside the realm of technical forestry. They embrace problems associated with tradition, human nature, and economics, in which most foresters have had too little experience.

The word "harnessing" implies a willingness on both parties to pull together to accomplish a common goal. If a team is to pull together, the members must at least trust each other; otherwise, much of the combined energy is wasted in bickering. Because of mutual suspicion, the southern farm woodland owner and industry are not natural team mates. This mutual distrust has developed over the years to the point where a farm woodland owner enters into a timber deal with the belief that he has been cheated before he starts. With this basic attitude, he does everything he can to out-trade industry. Large industry has always been considered fair game by the rural population. In part, this attitude may be attributed to a psychological condition—the small owner has an inferiority complex when it comes to dealing with a large corporation.

On the other side, there is the necessity of industry to obtain its raw material as cheaply as possible. Resort to unethical practices by a few has earned for the industry as a whole an unenviable reputation. With this atmosphere of mutual suspicion, it can be seen that the task of hitching these two interests together may never reach the point where the harness is put on. This hurdle is by no means insurmountable. There are many examples in the South where industry and land owners have joined together to obtain good forest management on farm woodlands. The accomplishments to date, while only a small fraction of the total farm woodland area of the South, have been aided, in no small part, by public effort. This effort has been in effect only a little over a decade, having started with the inauguration of the farm forestry program. This program has not only sold the idea of forest management to the small landowner and to industry, but it has acted as a catalyst to bring about the desired reaction between farm woodland owner and industry. The farm forester, being a disinterested party, has been able to allay much of the element of suspicion.

Industry in the South has expended considerable effort to promote better forest management on farm woodlands. The greatest effort has been put forth by the pulp and paper industry through its innumerable conservation foresters and widespread publicity. The

[1]Paper presented at the 51st annual meeting, Society of American Foresters, Biloxi, Miss., December 15, 1951.

lumber industry too is not without effort along these lines. The motive is sound. The reward for this effort is a future supply of stumpage, without which industry cannot exist. In part this explains why the pulp industry has made greater strides than the lumber industry in promoting forest management. The huge investment in a pulp mill makes it imperative that the investment be protected by an adequate supply of wood.

A majority of southern lumber production comes from small sawmills where the capital investment is often less than $4,000, most of which is borrowed. If the timber supply runs out, or the market drops, an operation of this kind can fold up overnight. The owner and his crew can usually find some other source of income other than the production of forest products. Some small sawmills have changed hands as often as twice a year. Hence, the urge to promote forestry is not compelling on a large segment of the South's lumber producing capacity.

The stable segment of the southern lumber industry has the same incentive to foster forest management among its neighbors as has the pulp industry. Many lumbermen do not own enough land to fill their needs, and a few of them have had notable success in selling forest management. Unlike the relatively new pulp and paper industry, most of the large sawmill operations were established in the days of virgin timber. Under prevailing conditions, it was considered good business to plan an operation that would amortize the investment in plant and equipment, by the time the original stumpage purchase was liquidated. There was no thought of a permanent operation. It has been impossible, in many instances, to change over from the original plan and, in some cases, where it might have been possible, human nature prevented breaking away from a long, established tradition.

Without the urge to prolong the business, there was no thought of seeking ways of building up supplies of stumpage. However, forest management in the South during the past 15 years has developed from a dream to a reality, and the tradition of liquidating an established operation is disappearing rapidly.

The other member of the team, the farm woodland owner, has made little effort to put good forest management into effect on his own lands. This has been the major drawback in harnessing industry and the farm woodland owner. The lack of interest or urge on the part of the landowner has several explanations. Probably the most important is that he is unaware of the benefits to be derived.

The tremendous flood of literature and numerous demonstrations have, no doubt, reached a majority of the farm woodland owners. This effort at education has acquainted them with the need for conservation, but it has not resulted in good forestry practices. Many small timberland owners believe in conservation for the same reason that they are against sin. They have been taught since childhood to hold these beliefs. When it comes to putting good forest management into effect, however, they are usually ignorant of the necessary steps. Public and private effort has tried to overcome this ignorance with bulletins and demonstrations, but the net result has been only to establish a belief. Charles F. Evans in discussing this problem once said, "You can't teach a man to ride a bicycle by giving him a bulletin on the subject." You cannot not teach a layman effectively to manage timber, especially if he is only going to undertake it as a side line and at long intervals. He can be taught to believe in conservation, a job well done; and he can be taught to recognize the need for some action, but some one will have to help him put the action into effect. The landowner employs outside skills for such work as surveying and construction. Why shouldn't he have assistance with his forestry problems? It would not be realistic to believe that every farmer should be a surveyor, carpenter, and jack-of-all-trades.

Another problem is the established custom of selling everything that will make a 2 by 4. Tradition often overrules common sense. Many farmers believe that the only way to sell timber and eliminate the risk of being cheated is to get the highest bid for everything merchantable. They do not have faith in industry to allow it to choose the trees in need of cutting and leave desirable stock. They hold firmly to the belief that industry will cut only the good trees and will damage or destroy the others. When the tradition of partial cuttings is established, then there will be just as many arguments in its favor as there are against it today. Forest industry in the South has a long road to travel to obtain the confidence of the farm woodland owners. Those members of industry that are able to establish confidence in their communities will have a valuable advantage over their competitors, and will eventually force them to adopt a similar policy.

Tradition and prejudice can be overcome by prolonged effort, but the problem of how to influence a citizen in the way he invests his capital is not one of easy solution. A forester can explain and prove conclusively the rate of return that can be expected from a well-managed forest, but the decision as to what action the landowner will take must be made by the landowner in the light of his own knowledge and peculiar circumstances.

For example, in the Piedmont section of Georgia, as well as many other sections of the South, there is an active expansion in the production of beef cattle. The development of good pastures, stocked with high-type animals, is taking the place of the scrub cattle left to forage for themselves on open range. This change in cattle farming is bringing about the clearing of good timberland. The cost of establishing year-round pastures and stocking them with pure bred cattle is high. Many persons who enter this field do not have enough cash or credit to finance the enterprise. Nearly every farm in the Piedmont has timberland unsuited for pasture. If the timber is merchantable, the landowner is sorely tempted to sell it to get money enough to start his cattle business. His ambition is often beyond his

resources, and he has to scrape the bottom of the barrel by cutting all merchantable trees.

Year-round pastures stocked with high type beef cattle require a total investment of $150 to $230 per acre. This investment, properly managed, is capable of a net return of 16 to 28 percent per year. If the capital were left in growing timber, can foresters assure a return equally as attractive? Cattle raising is just one of many investments open to a farmer. The manner in which a man employs his resources is, after all, the foundation of this country. If a man wants to change his investment because — rightly or wrongly—he believes he can better himself by so doing, that is his inalienable right in a free country.

In the rural economy, timber is frequently the only resource available for quick conversion into cash. During periods of crop failure, the farm woodlands of the South are often the only source of cash to carry the farmer through to the next year.

For the past 15 months, I have worked for a private lumber company, engaged primarily in the retail building supply business. This company in the past has obtained most of its lumber by offering a ready market for rough green lumber from small sawmills. Recently, the company has thought it desirable to enter the field of lumber production, but it has very little land from which to draw stumpage. This condition makes it wholly dependent upon its neighbors for timber. The company's policy is to sell forest management to timberland owners, and, once the idea is sold, to do the marking and otherwise guide the owner along the road to better forest production. We have had a measure of success, but our failures have outweighed our success in both area and numbers of people.

Certain types of people and situations preclude wise cutting practices. For example, the country trader or speculator — every small town has a number of individuals who make their living like vultures by preying on the cripples and the estates of the deceased. They are sharp traders, ever on the alert for some family catastrophe. When a landowner dies, they nearly run over each other to get to the heirs. If they are successful in controlling a piece of timberland, they call all the sawmill operators and ask for bids. Invariably, they specify cutting all the timber 8 inches in diameter and larger. When they think the price is as high as the traffic will bear, they sell the timber, usually keeping the land. In many cases, the value they receive for the timber exceeds the price paid for the entire property. There have been cases where the speculator acquires an option for $50, and then sells the timber before exercising the option. The receipts from the timber are used to take up the option. The speculator has risked very little and ends up by acquiring a piece of land at no cost. I have yet to convince one of these speculators to adopt a wise timber management program. There is nothing illegal about the strategy employed by this group, but its application can have a serious effect on the timber supply in the area where it is employed. There are also timber brokers that use the same methods, but they generally limit their efforts to trading only in stumpage.

Where a number of heirs are involved, scattered around the country, they are not interested in the old home place and want to get all they can out of the estate. Seldom can the heirs agree to anything like a reasonable forest management program. Here is a situation in which liquidation cutting seems to be inevitable.

Perhaps the situation most favorable to forest management is where the land is owned by a successful professional man, such as a doctor or lawyer. Such men have funds to invest in safe undertakings with good appreciation possibilities. They understand the capital gains provisions of the income tax law as it applies to timber. They take pride in ownership, and like to see the results of wise management. They do not have the insane distrust of the forest industry that is so prevalent among rural people; and business transactions are an every-day occurrence with them.

In spite of the problems in harnessing forest industry and the woodland owner, progress is being made. Those of us, however, who wish to reach the Kingdom of Heaven in one bound are in for a disappointment. Industry is going to increase its efforts to team up with farm woodland owners, because more operators will see that their future is dependent largely upon the well-managed forests of their neighbors. Simultaneously, more southern farm woodland owners will realize the benefits to be derived from accepting the aid of industry to keep them in the timber growing business. The two will come to realize more and more that their future lies in teaming together; but getting into harness is a slow, difficult, and complex proposition.

The trend is right even though the road ahead is long and rough.

The Impact of the National Emergency on Forest Resources[1]

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EXPANSION OF U. S. FOREST INDUSTRIES PROPOSED IN TAX AMORTIZATION APPLICATIONS

Product	Unit	United States Production 1950	United States Proposed expansion[2]	West[1] Production 1950	West[1] Proposed expansion	North Production 1950	North Proposed expansion	South Production 1950	South Proposed expansion
Pulpwood	Million Cords	2.5	0.5	1.3	0.5	0.3	—	0.9	—
Plywood	Billion Board feet	20.7	9.9	3.3	1.9	5.0	1.0	12.4	7.0
Lumber	Billion Board feet	38.0	0.5	18.5	0.4	5.5	[3]	14.0	[3]

[1]Including Alaska.
[2]A small part of this expansion was attained in 1950.
[3]Less than 0.1.

THE NATIONAL OUTPUT of lumber, pulpwood, and other forest products in 1950 amounted to a total cut of 52.5 billion board feet, 5 percent higher than in 1944. This was a new high level of production, reached before the expansion in plant capacity stimulated by the defense program. Much more could be said about the steady growth of forest products requirements tied in with population growth, raised living standards, etc. In fact, considerable has been said about it, so I would like to focus rather sharply on the size and character of the defense production program as we have seen it develop during 1951.

Installation of very sizeable new facilities is planned or under way, which will throw an additional burden on the resource, and tax the ingenuity and resourcefulness of foresters and management, to maintain uninterrupted production. These expansions have been stimulated by the availability of government loans for defense production, and principally by a provision of the Internal Revenue Code which permits investments made for defense production to be amortized at an accelerated rate.

The U. S. Forest Service has been asked by the National Production Authority to investigate and report on the adequacy of timber resources to support planned expansions. We have had no prerogatives or authority to grant or deny production loans, or accelerated tax amortization or to consider the need for the product to be produced, or the economic feasibiilty of proposed operations. Our job has been limited to appraising the timber requirements-supply aspects of proposed new production facilities.

Since the defense program was initiated about a year ago, 348 applications for forest industry expansion throughout the country have been referred to the Forest Service.[2] The value of facilities sought to be certified is 1½ billion dollars. The Defense Production Administration has already approved 104 applications involving facilities valued at 595 million dollars. It has rejected 60 applications. Thus, 184 expansions valued at 803 million dollars are still pending and may be regarded as potential new capacity. Most of the planned expansion, both in point of number of cases and dollar value of facilities, is by the pulp and paper industry. Most of it is planned for the East and South, although by the time new facilities are installed every timber producing region of the country will have felt the impact.

The West Coast

In the three Pacific Coast states, planned expansion has been greatest in the softwood plywood industry. From November, 1950 up to the present, 42 plant expansions valued at 29 million dollars were sought to be certified. These new facilities would raise total production to 3.2 billion square feet of ⅜-inch plywood by the end of 1952. This represents an increase of 50 percent over that produced in 1949. This expansion will require an estimated additional 598 million board feet of logs annually.

With timber cut in this area running around 21 billion board feet, the expanded plywood requirements do not loom large except as the total cut already exceeds the estimated sustained yield allowable cut, in the vicinity of some plants. On the other hand, there has been ample demonstration of the feasibility and practice of long distance transportation of veneer logs. Interstate shipments between California, Oregon, and Washington points have been very substantial. So it is logical to regard the entire Douglas-fir region as a single unit for consideration of plywood expansion. Large regional timber inventories thus help to justify new veneer and plywood plant construction in locations where the local timber requirements-supply situation is not favorable.

There are some other aspects of West Coast plywood expansions that are of interest in appraising the impact on timber:

a. New veneer and plywood plants will make for a greater diversification of facilities in a region where sawmills have always been dominant. This will make it possible to put more of the varied timber of West Coast forests to its highest use.

b. Plywood manufacture results in very close utilization of the log, and surprisingly enough affords a high use for many logs not merchantable for lumber. Specifications for peeler logs have been lowered greatly. Plywood is actually an outlet for part of what used to be woods waste—chunks, white pocket logs, etc. Two of the Pacific Northwest expansions are planned to be based exclusively on what hitherto have been logging leftovers. A number of others will be based partly on such material.

[1]Paper presented at the 51st annual meeting of the Society of American Foresters, Biloxi, Miss., December 15, 1951.

[2]Data for the period ending December 31, 1951.

e. Wood converted into plywood covers more square feet than the same volume used as lumber, so it makes what we have go farther. To a considerable extent, plywood is a substitute for lumber and it is reasonable to expect that from a timber drain standpoint, some new plywood production will be offset in the long run, by reduced lumber cut. It is reasonable to expect too, that some of this decrease in lumber production will be occasioned by closing of some sawmills which find they cannot compete for shrinking timber supplies with relatively wide margin plywood operations.

Planned pulp and paper expansions on the West Coast, as represented by applications for tax amortization, number 36 in all, valued at 130 million dollars. Of these, 8 have been denied by the Defense Production Administration, so 28 cases are approved or pending. These involve increased paper production and about 796,000 tons of new pulp production, an increase of about 30 percent over 1950. The latter will require an estimated 1,200,000 cords of pulpwood.

One of the largest of these pulp expansions is being planned for lodgepole pine timber of which there are extensive stands heretofore used but little. Nine are being planned to utilize substantial quantities of mill waste and logging leftovers equivalent to about two-thirds of the total new wood requirements. The net new drain on commercial standing timber is therefore small by comparison with the volume of high value pulp products to be produced.

Sawmill and other planned expansions in the three West Coast states total 14 in number and involve about 287 million board feet of additional timber drain. This is a very small increase in relation to the immense lumber production of that area.

Alaska

The most significant development in Alaska is the planned new pulp mill at Ketchikan involving an expenditure of 40 million dollars for which a certificate of necessity was issued. Start of construction is scheduled during the first quarter of 1952. Initial planned production is around 105,000 tons annually of dissolving pulp to be based on national forest timber. A veneer plant and two sawmill expansions are still under consideration by defense agencies. If installed, these new facilities will be an important step in the direction of bringing Alaska's immense timber resource to bear on the defense effort. At the same time they spell industrialization which will help the local economy and make the territory a stronger and more defensible outpost of the United States. The national forest timber committed to the new pulp mill in a 50-year sale is but one of five large tracts of high quality timber ready for cutting and awaiting interested capital.

The Rocky Mountain Area

In the whole Rocky Mountain region only 8 applications for defense production loans or tax amortization have been considered. One new pulp plant each for Idaho, Montana, and Colorado, aggregating 236,000 tons, and five small sawmill, pole, and wood-treating operations represent the size of the planned expansion.

The Colorado pulp mill if constructed will be based almost entirely on beetle-killed Englemann spruce. During the first 30 years of operation, far from representing an impact on the timber resource, it will be the means by which a large timber resource can be salvaged. The other two also, will utilize green and dead lodgepole pine in hitherto inaccessible areas, and provide an outlet for little-used species and logging leftovers. As on the West Coast, such plants will make for better integration or diversification of facilities. That is needed, and in view of the excessively concentrated timber drain in other parts of the country, it is unfortunate that the large unused timber resource of the Rocky Mountains has not been found more attractive to American industry.

The North Central States

In the North Central States, 61 applicants seeking certification of new facilities valued at 89 million dollars are evidence enough that this old forest-products-producing part of the country is still in the running. However, 41 of these expansions relate to paper and rayon textile production based on pulp purchased from many sources, and do not entail direct new pulpwood drain.

There have been some denials, so 16 expansions involving facilities valued at 37 million dollars and promising new pulp production estimated at 236,000 tons annually, represent potential new timber drain of about 400,000 cords. Some of this additional pulpwood will be imported from Canada, and some from the Rocky Mountain States. But local resources will be called upon to furnish an estimated additional 180,000 cords annually. This will be almost entirely aspen and other hardwoods, and will amount to 42 percent of the total expansion requirements. This proportion of hardwoods as a base for the planned expansion, is in some contrast to the 25 percent of hardwoods used by Lake States mills in 1949. It shows that much has been learned about the use of hardwoods, with advantage not only to the economy of the region, but to the timber resource which presently includes surpluses of aspen and lower grade hardwoods.

Nevertheless, softwoods are still the preferred species in the Lake States and in largest demand. Installed capacity even before expansion was more than adequate to process available local softwood pulp timber as well as the usual imports from Canada and the Rocky Mountains. Therefore the potential pressure on softwoods has been increased. The importance to the future of the region's 500,000 acres of jack pine plantations, its 3 million acres of red and jack pine type in the younger age classes, and its spruce fir and hemlock producing lands is underscored as never before. That together with aspen and other hardwoods, is the region's hope and possibility for self-sufficiency 15 to 20 years hence.

The Northeast

The Northeast, like the North Central region, is the scene of much activity. The planned expansions are 85 in number, aggregating 276 million dollars in value. There have been some denials, and a number relate to rayon and paper production based on purchased pulp or waste materials. New pulp production aggregating 520,000 tons and 750,000 cords of pulpwood will result from 22 expansions valued at 83 million dollars if all now pending are finally approved and built. It is planned that a part of the additional pulpwood needed will be obtained in Canada. But additional local U. S. timber drain will amount to about 652,000 cords. Of this, about 445,000 cords or 68 percent will be hardwoods, which are in relatively long supply. It will be difficult to meet the expanded softwood requirements, and the need to increase growth of softwood pulping species is underscored.

The South

While the planned expansion in other regions has been large, circumstances have been such as to soften the impact upon the resource. In the South it is different. Virtually all of it entails new pulp production and hence timber drain. Here is where much of the pulp will be produced to support the rayon textile and non-integrated paper mills throughout the country. No foreign pulpwood is in prospect, nor is there any huge volume of logging leftovers as there is in the West to lessen the impact on standing timber. Even the plus or offsetting values of integration of facilities claimed for the West cannot be credited here in like amount because the number and distribution of pulpmills and sawmills has for years afforded diversified outlets for southern timber. In the main, the South's is a pine-based expansion. The South has embarked on a huge undertaking and is wholly on its own resources.

The size of the undertaking may be gauged by the number of planned new facilities, 94 valued at 845 million dollars. These include 60 pulp expansions, 17 paper expansions, 7 rayon textile plants, and 10 small lumber, veneer, and other installations. Of the applications for new or expanded pulp mills, 28 representing 329 million dollars and 2¼ million tons have been finally certified by DPA. There have been a few denials, so 29 applications still pending represent an additional 330 million dollars of planned investment and 2 million tons of pulp. Wood requirements for the approved and pending pulp mills are in the neighborhood of 6-½ million cords.

As in other parts of the country, the Forest Service has studied and reported on the adequacy of the timber resource to support each of these expansions. It was a large job, and difficult because every applicant could not be given the satisfaction of a favorable report. Concern for the resource had to be considered against requirements of the defense program, as determined by defense agencies, and there was that sobering fact that the Forest Service was the only agency taking a good hard look at the aggregate as well as the individual impact of expansions on timber supplies.

Some of the considerations regarded as important in appraising proposed expansions are as follows:

In the first place, pine timber growing stock was the important consideration because so much of the expansion is planned to be based on pine, and because of the general overdraft on this species throughout large areas by existing industry. The Forest Survey discloses this overdraft situation. It also shows a current surplus of pine timber growth over drain in some areas, but totally insufficient to sustain all the planned additional drain from those areas.

Therefore, in recognition of urgent defense requirements, and the very favorable recent developments in southern forestry, an attempt was made to evaluate those developments and trends in terms of their effectiveness in increasing future pine growth. Improved fire control, for example, is a most significant development of the last several years. More intensive utilization of tops and thinnings, larger planting programs, and improved cutting practices, represent accomplishments and trends that will some day mean more wood. Negative trends were also evaluated such as hardwood encroachment, and some allowance was made for increased drain by industries other than pulp.

This evaluation of positive and negative forestry trends indicated a prospective increase in pine timber growing stock, and prospective surpluses of growth over drain, for certain portions of the South. Other large areas could be credited with no such prospective surpluses, but with a continuing deficit of pine growth.

As might be expected, planned expansion in these so-called deficit areas have been fewer than in the more favorable areas. That is another way of saying that the situation there is recognized by industry. In some cases planned pine requirements were reduced as a result of discussion with applicants, or supplanted entirely by the planned use of hardwoods, or of pine cut and removed from more favorable areas. Some just could not be regarded favorably under any criteria that had regard for the resource and the needs of established industry.

The more favorable areas too were recognized by industry, and expansion after expansion is planned which will draw wood from the same general procurement territory. The important thing to bear in mind—and it cannot be emphasized too strongly, is that these pine-based expansions are planned and are being installed on the strength of *prospective* growing stock. Although there are some *local current* surpluses of growth over drain, these are not sufficient, and what there is, is before provision for building up growing stock, and getting lands to produce more nearly what they can and should. So in a very large sense the wood is on order. It must be produced before it can be utilized.

Improved though it is, the South does not yet have the degree of

fire protection necessary to achieve the assumed future growth. It does not have the assumed planting program, and more important the full amount of the growing stock that is to yield the assumed growth is not yet in being. The South does not yet have the widespread management practices, nor the education and technical assistance programs that will be needed. The positive forestry trends must be continued and accentuated if all wood-using industries in the South are to be supported on a permanent basis. This is the business of foresters and enlightened management and cooperating state and federal forestry agencies. And this is why I say that upon you men, your work, and your influence on the course of events, depends whether and to what extent a great industry and the economy of a great region, flourishes. This is the real substance of what I have to say.

The impact of an 800 million dollar expansion program by the pulp and pulp products industries will be great and it will be felt in many ways. One clear new fact is the change in thinking as to the amount of land and timber it is economically feasible and desirable to own. Land purchases by expanding plants have been proceeding at an unprecedented rate. And prices—well never more can it be said that the practice of forestry lags because of failure to ascribe value to land and timber, and to pay for it.

More of the South's hardwoods, unsuited to other uses, will be converted to pulp and pulp products with advantage not only to the stand, if properly harvested, but to employment and income opportunities in the region. One of the finest and most satisfying aspects of the current wave of plant expansion is the planned utilization of 2.4 million cords of hardwood pulpwood, about 35 percent of expansion requirements.

On the other hand, 4 to 5 million cords of additional pine drain will most certainly postpone and render more difficult the attainment of reasonable growth goals, especially for sawtimber. Inevitably a lot of additional timber will be earmarked for pulp mills, either through purchase or through the mere existence of new pulp capacity in an area. Sawmills will find the going that much harder. The implications are greater than the welfare of individual sawmills. The nation is dependent on the South for 37 percent of its annual lumber requirements, and the whole question of balanced production is raised.

The large pulp expansion will intensify the scramble for open market stumpage and increase pressure on the land that supplies the open market—the smaller ownerships. Those are the properties that are getting the least care and management. Federal, state, and private forestry programs which have helped the owners of these lands, but which have hardly scratched the surface of the job to be done, need to be extended and intensified.

In Summary

Planned expansion of facilities to produce lumber are few and relatively unimportant. This is true in all regions. The large expansion of other industries using sawlog material will necessitate the lumber industry adjusting to a growing shortage of the larger sizes, higher grades, and preferred species.

On the West Coast planned pulp and plywood expansions are in line so far with the amount of raw material available and suitable for such purposes. The volume of additional standing timber to be utilized is small by comparison with the volume of high-grade products to be produced, because of the extensive planned use of mill waste and logging leftovers. The new plants will help diversify and bring balance to forest products industry, and improve utilization. The net new timber drain, what there is of it, will further intensify competition for open market stumpage with likely adverse effect upon some established plants.

In Alaska, a start is being made in development of the extensive stands of high quality timber in the national forests.

The Rocky Mountain area is as yet relatively unattractive as a base for expanded industry operations. The few new plants in prospect will, if installed, help with the salvage of insect-killed timber and the utilization of hitherto inaccessible and little-used species.

The North Central and Northeastern states are the scene of many forest products industry expansions. About one-third of these involve direct new pulpwood requirements, mostly hardwoods which are in relatively long supply. However, softwoods are the preferred species their availability is limited, and the need to increase stocking and growth is paramount.

The South is being called upon to accommodate the greatest expansion. In the main it is a pine-based expansion, and current surpluses of pine timber growth over drain, where they may be found, are totally inadequate to support it. The expansion is being planned and installed on the strength of prospective surpluses, expected to materialize as a result of progressively better and more widespread forestry. The South's forests have shown in recent years how they can respond to care and management. It is squarely up to foresters, to management, and to cooperating state and federal forestry agencies to see to it that the positive forestry trends are maintained and accelerated.

Nationally, a new peak in forest products production was attained in 1950. During 1951, the defense program has stimulated a tremendous expansion of facilities that will further increase the drain on American forests. Attainment of reasonable growth goals which call for doubling the sawtimber-growing stock in the East and increasing all timber-growing stock there by 50 percent, is rendered more difficult. Truly, the country has accepted a challenge and this one, in view of recent world events, the need for national strength and security, and our obligations and commitments to the free world, we have got to meet.

The Sampling Design Used in the Forest Survey of the Northeast

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Sampling methods are designed scientifically to obtain the best accuracy possible for a fixed amount of money or to meet a fixed standard of accuracy at the least cost. The author describes the sampling design developed by the U. S. Forest Service in the forest survey of the Northeast. A similar design could be used in cruising small forest tracts.

THE STARTING POINT of almost any venture in forestry is a reliable estimate of the volume in standing timber on the area. Such an estimate of volume is needed in buying or selling forest land, in harvesting forest products, and in putting a forest property under scientific managment.

Many methods of estimating timber volume have been used. They have ranged from a mere guess to measurement of all the trees on the tract. Of course a complete inventory is expensive. A 10-percent cruise, experience has shown, is reasonably reliable; but it is still only a crude compromise between the requirements of accuracy and the limitations of cost.

The question of what is the best cruising method for the nationwide forest survey has been studied and various systems have been tried. This paper is written to explain the design the U. S.Forest Service uses in the Northeast and to show how it may have practical application for owners and managers of forest land.

Scientific Sampling in a Timber Cruise

Since it would be impossibe to count every tree in the forests of the Northeast, a sampling method is used to get representative samples. These are "blown up" into reliable estimates of volume. The methods and principles used in the forest survey are equally appropriate and valid for smaller areas.

Stratified random sampling has been described by Schumacher and Chapman.[1] It amounts to dividing an area into a series of distinct classes (strata) and then sampling within each class to obtain averages for it. When there are real differences between classes, stratified random sampling is more efficient than unrestricted random sampling. In an illustration, Schumacher and Chapman showed that one stratified sample was equivalent to eight unstratified samples.

To make full use of the advantages of this kind of sampling, aerial photographs are almost essential. With a stereoscope and certain visual aids, some of the attributes of forest stands can be measured. Costly ground work can be made more efficient, and the cost of timber cruising can be reduced. Improvements in aerial photography developed in recent years have made it less expensive and have increased interest in its possible use by foresters.

When the U. S. Forest Service resumed its forest survey work after World War II, Osborne, Blythe, Chapman,[2] and others developed a method called "triple sampling" (from the sampling within a sample of a sample). This method has proved efficient and useful.

The principle of stratified random sampling has been used in estimating timber volume in the Pacific Northwest.[3] Here the strata were delineated on aerial photos, and random samples were taken within each stratum to get an estimate of average volume. This method has also been tried in the Northeast, but in this region it may be difficult to delineate strata accurately and, for some purposes, delineation may not be necessary.

A method of double sampling has been described by Neyman.[4] Neyman is concerned with human beings and writes in terms of individuals and populations, yet his method applies just as well to trees as it does to people. In his theoretical population, each individual has two attributes: X and Y. Mean X is what he wants to find, but each measurement of X is costly. Y, on the other hand, may be obtained at a low cost for each individual. Furthermore, X is correlated with Y, but the nature of the regression is unspecified, perhaps unknown. The population is then stratified on the basis of Y, using a relatively large sample. From each stratum a small sample is drawn to determine mean X for the class. Neyman includes a complete mathematical derivation of the formulas needed to apply this method. Only the application of the method to problems of forest inventory will be considered here.

The purpose of this, or of any other scientific sampling design, is to obtain the most accuracy for a given cost, or to meet an accuracy standard at the least cost.

The Method We Use

The sampling design used in the forest survey in the Northeast is essentially that described by Neyman. We seek total volume, which is merely the product of area and mean volume. A determination of volume from ground plots is expensive. But we can classify plots from aerial photographs at a very low cost per photo plot. And plot volume is correlated with photo class.

Number of plots required.—Our first step is to estimate the number of ground plots needed for the par-

[1]Schumacher, F. X. and R. A. Chapman. Sampling methods in forestry and range management. Duke Univ. School of Forestry Bul. 7. 213 pp., illus. 1942.

[2]Chapman, R. A. Triple sampling design for forest survey. U. S. Forest Service. 13 pp. Washington. 1947.

[3]Wilson, R. C. Controlled forest inventory by aerial photo. Timberman 51: 42-43, 98, illus. 1950.

[4]Neyman, J. Contribution to theory of sampling human populations. Jour. Amer. Statis Assoc. 33: 101-116. 1938.

ticular area. Usually the area is a county. To do this we use Neyman's equation 53:

$$(1)\quad m_o = \frac{Ca}{aA + b\sqrt{AB}}$$

in which m_o is number of ground plots, C is total cost budgeted for the area, A is cost of a ground plot, B is cost of a photo plot, and a and b are parameters defined by:

$$(2)\quad a = \Sigma P_i S_i \quad \text{and}$$

$$(3)\quad b^2 = \Sigma P_i (X_i - \bar{X})^2$$

in which P_i is proportion in *ith* class, S_i is standard deviation of volume of *ith* class, x_i is mean volume of *ith* class, and $\bar{x}$ is mean volume of the area. Reasonably good estimates of a, b, A, B, and C are now available for use with this formula. Computed m_o is rounded to the nearest integer.

Next the number of photo plots is estimated from a rearrangement of Neyman's equation 5:

$$(4)\quad N = \frac{C - m_o A}{B}$$

in which N is the number of photo plots, rounded off to the nearest integer. The efficiency of these numbers may be verified by using m_o, $(m_o - 1)$, $(m_o + 1)$, and associated Ns in equation (8) below.

Next we determine the number of photo plots per aerial photo. This is simply N divided by the total number of prints, rounded off to the nearest integer. Photo interpreters then examine these N plots under stereoscope and classify them to determine proportions by strata. The number of ground plots by classes are determined from a simplified approximation of Newman's equation 41:

$$(5)\quad m_i = m_o \left(\frac{P_i S_i}{\Sigma P_i S_i} \right)$$

in which m_i is rounded to nearest integer.

Examining the aerial photographs.—In forest survey work we have commonly used three photo plots per print. Templets with 2, 3, 4, and 5 points per print have been prepared so that the point may be printed on the photographs mechanically, using a multilith machine. Each point locates a photo plot. Thus our sample is arranged systematically on the photographs. Our estimate of mean x is unbiased. But the fact that our plots are not closely spaced may result in an overestimation of variance.[5]

These photo plots are listed by plot number, using project and print number for convenient identification. On the forms we use, photo-plot number is written in at the left margin and photo class is shown by a check in the appropriate one of nine parallel columns.

Photo class is determined by examining the stand in which the point falls. We use a stand of at least 1 acre in classifying the photo plot. In our experience there is so much variation in the volume of stands where height, density, and crown diameter are measured to be the same, that we have relied on our interpreter's estimate of volume rather than on measurements alone. This is an important detail of technique that should be studied further. The advantage of aerial photos in timber cruising can be obscured or lost by careless or inaccurate photo-interpretation.

Choosing the ground plots.—The form that is used to record photo class has been designed for convenience is selecting ground plots for examination. The number of plots for each class is obtained from equation (5). Number of photo plots in a class, N_i, divided by required number of ground plots, m_i, gives the sampling interval, I, for the class.

Plots are chosen for ground examination by obtaining a random number between one and I; this plot and every I*th* plot thereafter is a ground plot. These are identified by counting down the proper column and circling the selected plots as they are counted. Thus ground plots are chosen at random by photo class.

Measuring the trees on the plot.—Each ground plot selected for examination is located as exactly as the quality of the photography and the skill of the interpreter permit. The plot and stand (at least 1 acre) are then classified for purposes of estimating forest-area statistics. All trees on the plot are then measured to provide estimates of average volume by classes. Sawtimber trees are measured on a circular 1/5 acre; pole-timber trees are measured on 1/10 acre.

Thus our area statistics provide information on the distribution of area in stands of 1 acre or more in size. Variation in volume, on the other hand, is for 1/5-acre plots, assuming uniform variation of volume in pole-timber trees by 1/10 acres.

Estimating the total volume.—Total volume, V, is estimated from the product of area, A, and average volume per acre, $\bar{X}$. But average volume per acre is the sum of the products by classes of P_i and X_i, the proportion of area in the class, and the mean volume of the class, respectively. Thus:

$$(6)\quad V = A(P_1X_1 + P_2X_2 + \ldots + P_kX_k)$$

Which may be written as:

$$(7)\quad V = F_1(x_{11} + x_{12} + \ldots x_{1m_1}) + F_2(x_{21} + \ldots + x_{2m_2}) + F_k(x_{k_1} + \ldots + x)$$

Thus total volume is the sum of the products of class factors and the sum of measured volume within the class. The class factors are:

$$F_i = \frac{AP_i}{m_i} = \frac{AN_i}{Nm_i}$$

These are computed from plot data by classes. Instead of computing the sum of measured volume by classes, the volume of each tree is multiplied by the appropriate class factor.

For each measured tree we have a punched card that shows its volume and an expanded volume (tree volume multiplied by an appropriate F); the sum of these expanded volumes over all trees and stand classes is estimated total volume for area A.

Calculating the sampling error.—The sampling error provides the reader with a measure of the reliability of reported volume. Our accuracy goal is a sampling error (using the standard deviation of mean volume) of 5 percent per billion cubic feet. This error may be computed from:

$$(8)\quad S^2 = \frac{a^2}{m_o} + \frac{b^2}{N}$$

in which a and b^2 are defined in equations (2) and (3) and S is the standard deviation of $\bar{X}$. This sampling error may be expressed

[5] For more detailed discussion of this problem, see Osborne, J. G. Sampling errors of systematic and random surveys of cover type areas. Jour. Amer. Statis. Assoc. 37: 256-64. 1942.

in percent by $100S \div \bar{X}$. Sampling errors of areas are computed with appropriate formulas from the binomial theorem.

An Illustration

Suppose we know the total area of a given county is 336,600 acres and that according to reappraisal data 104,000 acres were forested. Assume that $0.0039 per forest acre is budgeted for the inventory phase of forest survey; this gives us $405.60 for doing the field work of the inventory in this county. This is the C of equation (1). On the basis of forest survey experience in the Northeast, we also know the following averages: $A = \$17.27$; $a = 394$; $b^2 = 355921$; $B_1 = \$0.21$; $B_2 = \$0.02$ where B_1 is the cost of a forest photo plot and B_2 is the cost of a nonforest photo plot. $B = P_f B_1 + (1 - P_f) B_2$. Now P_f is $104000 \div 336600$ or 0.309 and B becomes $0.07871. The following were calculated: $b = 597$; $a^2 = 155236$; $\sqrt{AB} = 1.1659$. Substituting these values in equation (1) gives:

$$m_s = \frac{(405.60)^2 \quad (394)^2}{394(17.27) + 597(11659)} = 21.3 \ldots$$

Then, from equation (4),

$$N = \frac{405.60 - 21(17.27)}{0.07871} = 545.4 \ldots$$

If m_s were 20, N would be 765 from equation (4). If m_s were 22, N would be 326. Substituting these three numbers in equation (8) gives:

at $m_s = 20$, $S^2 = \frac{155236}{20} + \frac{355921}{765} = 8227.06$

$m_s = 21$, $S^2 = 7392.19 + 653.87 = 8045.26$

$m_s = 22$, $S^2 = 7056.18 + 1091.78 = 8147.96$

Thus our best design, in which S^2 is least, is found with 21 ground plots and 545 photo plots. If 185 prints cover the county, we would use $545 \div 185 = 2.94 \ldots$ or 3 plots per print and interpret 555 (3 times 185) photo plots.

Suppose photo interpretation revealed 13 plots in class I; 40 in class II; 45 in class III; 81 in class IV; and 376 in class V. To distribute the 21 plots by class, we prepare Table 1.

To get the sampling interval, divide the number of photo plots by mi. For class I, $13 \div 4 = 3\frac{1}{4}$; so the sampling interval is 3. Select a random number from 1 to 4; it, and every 3rd thereafter, is a ground plot in class I. In like manner:

Class	Sampling interval	Rank of first ground plot
II	$40 \div 8 = 5$	1 to 5
III	$45 \div 5 = 9$	1 to 9
IV	$81 \div 3 = 27$	1 to 27
V	$376 \div 1 = 376$	1 to 376

Going to the selected plots, measuring the trees, and compiling the data introduce no new or troublesome problems.

TABLE 1.—DISTRIBUTION OF GROUND PLOTS BY STAND CLASS

Class	Photo plots N	Proportion P_i	Standard deviation[1] S_i	$P_i S_i$	mi
I	13	0.024	1083	26	4
II	40	0.072	797	57	8
III	45	0.081	443	36	5
IV	81	0.146	138	20	3
V	376	0.677	6	4	1
Total	555	1.000		143	21

[1]Experience values from similar areas.

The sampling error is obtained from equation (8) for variance of mean volume. The S_i values of Table 1 are experience values from other similar areas. When computing the sampling error, standard deviations should be obtained from the data of the particular cruise. Class values for the standard deviation are calculated as usual from the square root of the average squared deviation. Computations are completed as illustrated in Table 2.

In these computations, $a = 134.7$ from equation (2) and $b^2 = 86,649$ from equation (3), and from equation (8)

$$S^2 = \frac{134.7^2}{21} + \frac{86649}{555} = 864 + 156 = 1020$$

and S is 31.9 . . . which is 31.9(100) $\div$ 127 = 25 percent of mean volume, a rather large error for this county alone. Adjusting to a billion cubic feet, however, reduces the error to 5.3 percent, which is reasonably good performance for less than ½-cent per forest acre!

Other Applications

This design would be of only academic interest if the forest survey were the only prospective user. But it should be useful in many other ways. An obvious application would be in the inventory of a medium to large forest property when a stand-class map is unnecessary. Repeated harvesting using selective partial cutting should result in a forest that would be especially suitable for this design. Let's see how we could change it for such a cruise.

In the first place, the formulas are equally applicable to large or small areas, with or without nonforest as a class. The formulas also apply to any series of classes that may be defined as well as those used in forest survey. There is one possible difference: management may prefer to specify a standard of accuracy rather than a total cost. In this case we use:

$$(9) \quad m_s = \frac{a(aA + b\sqrt{AB})}{AS^2}$$

which is deduced from Neyman's equations 5, 44, and 53; and

$$(10) \quad N = \frac{m_s b^2}{m_s S^2 - a^2}$$

a rearrangement of Neyman's equation 44, in which S may be any arbitrary value used for the desired standard error of mean volume.

Parameter values obtained from forest survey experience for a, b, A, B, B_1, and B_2 are applicable only to the degree that methods and stands are comparable. If forest-survey procedures are followed as closely as circumstances permit, values of these parameters should be generally similar.

The values of a and b depend upon the forest and the skill of the photo interpreter; in a particular situation they may vary either way from the averages used in the above illustration. Neglecting nonforest land will have little or no effect on a but b will be reduced. A forest that has received a series of partial cuttings should have about the same range in volume per 1/5 acre

TABLE 2.—CALCULATION OF THE SAMPLING ERROR

Class	P_i	S_i	$P_i S_i$	X_i	$P_i X_i$	$P_i(X_i - \bar{X})^2$
I	0.024	1132	27.2	1432	34.4	40,873
II	72	702	50.5	727	52.3	25,920
III	81	397	32.1	331	26.8	8,874
IV	146	161	23.5	87	12.7	234
V	677	2	1.4	1	0.7	10,748
Total	1.000		134.7		126.9	86,649

as we have found in forest survey. We would further expect a smaller area in the lower volume classes offset by an increased area in the higher volume classes. Such changes should increase the values of both a and b, but relative values should be little changed without new developments in photogrammetry.

For the type of cruise we are considering, nonforest land would be almost entirely excluded. If only forest land is interpreted, $B = B_1$; it is unlikely that B_1 would differ appreciably from the forest survey average. Cost of a ground plot, on the other hand, is less stable. It depends mainly on accessibility, skill of crew members, rates of pay, and distance between plots. For a particular cruise, the forest manager will be able to make an adequate estimate of this element of cost.

Another Illustration

For this case, suppose the owner wants to know volume present with a sampling error of 10 percent, two times in three. Suppose further that the area is entirely forested and $\overline{X}$ is 1,200 cubic feet. Thus S is 120; a is 600; b^2 is 592,900; A is 20; B is 0.2; a^2 is 360,000; b is 770; $\sqrt{AB}$ is 2. Then from formula (9):

$$m_o = \frac{600\,[(600)(20)+(770)(2)]}{20\,(120)^2} = 28.2$$

And from formula (10):

$$N = \frac{28(592{,}900)}{28(120)(120) - 360{,}000} = 385$$

In like manner, N is 557 when m_o is 27 and N is 299 when m_o is 29. Cost from Neyman's formula (5) may be estimated thus:

at $m_o=27$; $C=27(20)+557(0.2)=\$651.40$
$m_o=28$; $C=28(20)+385(0.2)=\$637.00$
$m_o=29$; $C=29(20)+299(0.2)=\$639.80$

Thus the most efficient design would use 28 ground plots and 385 photo plots.

Resume

The sampling design used by forest survey in the Northeast has been explained and illustrated. In addition it has been pointed out that this design may be useful in ordinary timber cruising when a stand-class map is unnecessary. A few additional words of caution and advice may be helpful.

This method, as Neyman pointed out, is a very powerful tool under favorable circumstances. Its advantages depend on the relative costs of photo and ground plots and the extent to which total variance is reduced by stratification. To apply this method, it must be possible to make some reasonably good estimates of the parameters a, b, A, and B; and to know either how accurately you need the data or how much you can spend to obtain the information. When all these conditions are met, you can then compare the method with other alternatives.

A small area with trees of high value is best inventoried by a complete enumeration. It is possible for a design formula to require more plots than there is room for within the area. In such a case, or when it is more costly to obtain the indicated sample, the inventory should be complete rather than use any form of sampling.

Unrestricted random sampling is the best theoretical design for a forest without usable stratification. Such forests are uncommon, but where there is little range in volume per acre, a few randomly located samples offer the most efficient procedure.

If no photographs are available and there is no other basis of stratification, observations may be taken on a series of plots along one or more survey lines or on a series of cruise strips. One or the other of these methods may also be used in place of unrestricted random sampling.[6] In either case, the design should permit an estimate of sampling error, which means some form of random sampling that gives each acre (or other sampling unit) an equal opportunity to be drawn. Before accepting these limitations, the possibility of procuring usable aerial photographs should be explored.

Use of delineated strata, as described by Wilson, is the best design when a map of the classes serves a useful purpose. A type map is nearly always desirable. A stand-class map would show area by volume class and would require continuous revision to be accurate. Such maps may be useful to the forest manager in many ways. They help identify areas approaching merchantability. They may also indicate areas that should be examined for possible silvicultural treatment such as planting or thinning. And they may be useful in organizing to combat a threat from fire or insects.

In general, however, for such maps to be useful, the forest should be mapped into relatively large areas of more or less even-aged stands of simple composition. The usual forest in the Northeast is composed of a dozen or more species, with several ages represented on most acres, in a crazy pattern of small irregular stands merging from one class to another in a manner that makes delineation very difficult. For these forests, the design we use has worked out very well for forest survey. This design should also be efficient for many timber-cruising situations on private land.

[6] See chapter 3 of Schumacher, F. X. and R. A. Chapman. Sampling methods in forestry and range management. Duke Univ. School of Forestry Bul. 7. 213 pp., illus. 1942.

Profit Possibilities From Intensive Management of Loblolly Pine[1]

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TIMBER GROWTH possibilities on the Crossett Experimental Forest in southern Arkansas are similar to those found on many millions of acres of the southern pine belt. Topography is level and the soil is a silty loam. The site index for loblolly pine averages 85. The frost-free growing season is about 218 days. Rainfall averages 52 inches per year, but most of it comes in the winter. Except on days of heavy rain, logging and pulpwood cutting is carried on the year around.

Stand Conditions Prior to Adoption of Intensive Management

The virgin timber that was present on the area was cut to a 12-inch diameter limit in 1915. At that time, no one though of sustained yield management—or even of a second cut of forest products. This, coupled with the fact that good fire protection on the area dates from only about 1933, indicates that the stands with which we started management in 1937 were very similar to much of the cut-over pine lands west of the Mississippi River.

These loblolly-shortleaf sites were not open or denuded areas. Recovery of the small, and often suppressed, pine had been remarkable; and reproduction in places had been good. As of 1937, pine 10 inches d.b.h. and larger averaged 32 stems per acre, of which 11 stems were 15 inches d.b.h. and larger.

Only the best of the hardwoods were cut when the virgin timber was removed. Consequently, nearly all hickory, gum, post oak, water oak, and elm were left regardless of size. Also left were many large but low-quality red and white oak, and a scattering of other species. The leaving of these hardwoods of seed-bearing size accounted for the fact that in 1937 the experimental forest contained almost as many stems and as much basal area per acre in low-grade hardwoods as there were in pine. In fact, hardwood greatly outnumbered pine in the diameter below 6 inches.

Improvement of the Growing Stock

In those early days it was apparent that a high volume growth of pine and good returns would depend upon early removal of the cull and low-grade hardwoods.

The cutting, girdling, or poisoning of these hardwoods cost from $2 to $5 per acre. We now know that this is one of the most profitable investments the average timberland owner can make in merchantable stands of the shortleaf-loblolly pine type. In fact, our timber stand improvement work has increased the cordwood growth of our stands by about 75 percent. Board-foot growth on our unmanaged stands that have no improvement cutting has averaged 294 feet (International ¼-inch rule) per acre per year, while growth on the more lightly stocked managed stands has averaged 418 board feet, or 124 more board feet per acre per year.

One hundred and twenty-four board feet of additional growth per acre per year might not sound like much. With stumpage at $30 per M, however, it is worth $3.72 per acre per year! Even if the improvement cutting cost $10 per acre, which would be much greater than average, the value of the increased growth would pay for the entire job in less than 3 years!

Other studies that have been under way on the forest for 10 or more years show the value of improvement work in young unmerchantable pine stands. Our so-called release cutting study is a good example of what usually happens when young pine reproduction is released from serious competition. On an area of some 16 acres, low-grade hardwoods had almost completely taken over the good pine site. The few pine trees scattered through the area had produced sufficient seed to provide a stand of about 1,200 pine seedlings per acre that were struggling along under the hardwoods. By 1939 many of these young seedlings had already died from the severe shading of the older hardwoods. It was also apparent that practically all the remainder would soon die if they were not released.

In the fall of 1939, three intensities of release were given the area. All hardwoods 6 inches in diameter and larger were cut from one-third of the area, all hardwoods 2 inches in diameter and larger were removed from another one-third of the tract, and all hardwoods 5 feet high and larger were removed from the final one-third.

The first treatment (cutting all hardwoods 6 inches and larger) was not sufficiently heavy to release more than a few pine, but the other two treatments gave excellent results. By 1949 (10 years later) many of the young released pine were well above merchantable size for pulpwood. By this time, too, the stand was so dense that it seemed desirable to make a light thinning to remove the rough and other lower-grade trees.

An operable cut was not possible on the area from which only hardwoods 6 inches d.b.h. and larger had been cut. The intensive treatments, however, produced better than 1½ cords of pulpwood per acre. Even at only $3 per cord for stumpage, these thinnings returned from $2.40 to $2.70 above treatment costs. What is more important is that the very good stand of pine that replaced the low value hardwoods will provide repeated cuts of more valuable products for 50 or more years in the future.

Obviously, fast growing individual hardwoods of good grade and species should not be cut to release any pine that may happen to be present. Likewise, it is a waste of money to girdle or poison hardwoods on areas having little or no pine, unless one intends to seed or

[1]Paper presented at a meeting of the Division of Forest Management, Society of American Foresters, Biloxi, Miss., December 14, 1951.

plant the area to pine. But on the better pine sites where low grade or cull hardwoods are interfering with the growth of pine—and there are millions of such acres—a thorough stand improvement job should prove as sound an investment as the original purchase of timberland.

Regulation of the Cut in Merchantable Stands

When work started on the Crossett Experimental Forest in 1937, the question facing many timberland owners was this: "Can we profitably continue to operate our plants and still build up our growing stock so that we can look forward to a greater production of better quality forest products in the future?" Because much forestry practice hinged on the answer to the question, we early set up a large scale study to find out.

The study was started on a 1,000-acre tract typical of much of the understocked, unmanaged, second-growth shortleaf-loblolly pine-hardwood land of the South. Forty-acre compartments have been cut on 3-, 6-, and 9-year cycles. The aim of management has been to produce the maximum of high grade sawlogs.

Suppressed, intermediate, and codominant trees in most pine stands are usually of the best potential quality. Unless such trees are very old, they will respond to release almost immediately. Equally important is the fact that all trees do not mature at the same age. Consequently, the silviculture employed has been a modified single-tree selection system in which trees are cut or left solely on the basis of the merits of the individual tree.

Stands that contain 10,000 feet per acre in trees 12 inches d.b.h. and above, at the end of the cutting cycle are considered fully stocked, and on these the cut is equal to the growth during the cycle. From the compartments that average only 2,000 board feet per acre, however, only half the estimated growth has been cut. And from 50 up to 100 percent of the growth has been cut from compartments that range from 2,000 to 10,000 per acre.

Over the first 10 years of the study an average of 1,755 board feet (Int. ¼-inch rule) of pine logs has been removed per acre. This was 37 percent of the original volume of about 4,800 board feet. Over the same period the pine growing stock increased 1,446 board feet to about 6,250 board feet per acre. Thus, we now have 30 percent more volume than when the study started.

The logs have averaged 109 board feet apiece. Forty-five percent of these logs have been Grade 1, and 29 percent Grade 2—and remember, we are definitely not high-grading our stands.

In addition to the pine sawlogs, we produced 625 board feet of hardwood sawlogs, 4½ cords of pine pulpwood, and 3½ cords of acid wood per acre over the first 10 years of the study.

If we had been managing 100,000 acres of similar land instead of the 1,000, our production would have averaged about 24 million feet of pine and hardwood logs, 46,000 cords of pulpwood, and 36,000 cords of acid wood per year. The annual production has been high enough to interest almost any landowner, and at the same time we have built up the growing stock to a very real amount.

Stumpage Returns

By present-day standards, the stumpage price we received for the products cut in the early years were very low. They averaged about $10 per 1,000 board feet for sawlogs, $1 per cord for pulpwood, and $0.50 per cord for acid wood. Even so, the gross return for the products, plus the value of increase in growing stock has amounted to $32.90 per acre, or $3.29 per acre per year.

Although stumpage prices in 1949 were considerably below those of today, the gross stumpage returns plus value of increase in growing stock would have amounted to $79.65 per acre, or $7.96 per acre per year, had 1949 prices prevailed throughout the study period.

What It Has Cost

What has it cost to produce these values? No two landowners could agree on that figure. No two have the same set of costs.

However, we have used what we think is an average for land being managed intensively under present-day standards. We are assuming that a cruise and a revision of the management plan are necessary at 10-year intervals, that roads will either have to be built or existing ones improved, and that these should be spaced at about 1-mile intervals. We know that some timber stand improvement work will be necessary. Although the matter is somewhat subject to argument, it seems that there should be at least one technical forester per 25,000 acres, and that each forester will have a non-technical assistant—both will have a car or truck.

If road construction costs are charged off over the useful life of the road and a similar procedure followed for such items as cruising and timber stand improvement, we have a cost of about 73 cents per acre (Table 1).

Table 1.—Current Expenses for Intensively Managed Forest Land

Item	Cost per acre per year
	Dollars
Road depreciation	$0.11
Road maintenance	.11
Cruise and management plan	.02
Timber stand improvement	.04
Car depreciation	.02
Taxes	.12
Fire protection	.04
Timber marking	.06
Car expense	.02
General supervision	.19
	$0.73

If we accept this figure as a reasonable one for cost of management, then our net returns would be $2.56 per acre per year when based on 1937-46 stumpage prices, or $7.23 when based on 1949 stumpage prices.

Interest on the Investment

The pine and hardwood growing stock on the experimental forest in 1937 was worth a maximum of about $36.50 per acre. However, in those days, practically no one who purchased timberland paid anything approaching full stumpage value for the potential forest products present. It was customary to pay one to two dollars for the land and about one-half of the

stumpage value of the products. On this basis, the study stands would have cost about $20.25 per acre—in fact, a good many thousand acres of similar stands were purchased for a figure much less than this. If we do assume a timberland investment of $20.25 per acre as of 1937, the average net annual profit, based on the actual selling prices for the forest products produced during the 1937-46 period, would have been about 13 percent yearly. This, of course, is interest on the investment, plus profit and risk.

Many of you will question the wisdom of using such a low value as $20.25 as the investment value of the property. You may rightly assume that this value did not represent true worth. You will say that land could be purchased at such a low figure in those days because prospective sellers of timberland did not realize the income possibilities.

Then let's start over. Let's assume that the area was purchased in 1949 and that 1949 stumpage prices were paid for all the merchantable material on the forest.

The value of the growing stock present in 1937, computed by log grade, species, and product on the basis of 1949 stumpage values, is $115.82 per acre.

Since we have used 1949 values to arrive at a growing stock value we likewise should apply 1949 values to the products cut and the growth added to the growing stock. If we do use the figure of $7.23 per acre per year arrived at earlier, the indicated return for profit and risk plus interest on the investment is still approximately 6½ percent—and the prospects are for considerably greater earnings once when the stands are in better shape.

There Are Losses

Now I don't want anyone to get the idea that all is milk and honey as far as management of shortleaf-loblolly pine is concerned. We do have our troubles. Ips and Dendroctonous bark beetles and pine sawflies cause some damage and every once in a while outbreaks, such as the one now under way in eastern Texas, become serious. Every few years ice storms break and damage many trees.

However, anyone who has seen beetle, or ice, or pine sawfly, or fire damage, is bound to be amazed at the rapidity with which the forests recover. If a seed source is available following the catastrophe, 10 to 15 years is often all that is required to bring the area back to pulpwood-size trees.

Altogether it seems possible that we can absorb these losses handily and at the same time have complete confidence that timber management can be a very profitable business for any reasonably good operator.

What Constitutes Intensive Management?

In closing I'd like to made an observation about the term *intensive management*. I am sure that you have often heard it said that this or that company, or individual, or national forest has intensive management. Undoubtedly some of it is intensive for this day and age. I don't mean to belittle in the least the wonderful advances that have been made by the many private owners and the national forests in the South. At the same time, you sometimes wonder just how close we are to getting maximum production from even our most intensively managed areas.

We think that we are doing well if we get our stands in such shape that low grade or cull trees are occupying only 20 to 30 percent of the area and only 10 to 20 percent of it is open. We think that if, over relatively large areas, we bring our average growth up to 300 board feet per acre per year (regardless of quality) and our gross returns up to $7 per acre per year we are really managing intensively.

But are we? On the Crossett Experimental Forest a few of the good pines, 20 to 25 inches in diameter, are entirely free of limbs for two or more logs, and, for this portion of the bole at least, are producing all clear lumber. Many of them are growing 3 or more inches in diameter each 10 years and are increasing in value at from $1 to $2 per tree per year.

On good river bottom sites in the Crossett area a few cherrybark oaks, 30 to 40 inches in diameter, are growing 5 or 6 inches in diameter each 10 years. Some are entirely free of limbs for 2 to 3 logs, and such logs are high-grade veneer quality. Even at conservative stumpage values, trees like these are increasing in value at the rate of $4 to $6 per tree per year.

When you see trees with such a very large earning capacity you wonder what the earning power of many of our good pine and hardwood sites would be if foresters were smart enough to have five to ten such trees present on each acre.

Anyone who has studied the growth possibilities of shortleaf-loblolly pine on average to better sites knows that it is not very difficult to obtain a growth rate of 2 cords per acre per year on pulpwood rotations and 500 board feet per acre per year on sawlog rotations once the stand is built up to reasonably good stocking. Under such conditions, gross returns can easily be $10 or more per acre per year. If so, then southern foresters can well afford to, and some day will, spend $15 or more per acre to get each acre and each part of each acre into full production. We most certainly are a long way from this now, even in so-called intensively managed areas.

Modern Trends in an Ancient Industry[1]

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THE NAVAL STORES INDUSTRY, once a dominant influence in southern forestry, now lags behind the lumbering and pulpwood industries. Although the trend still is downward, turpentining has a permanent place in good forest management, a place that can be indicated by review of past practices and current developments.

Production of naval stores began soon after the arrival of the first settlers in America. Prior to 1865 the principal products were tar and pitch for the construction and maintenance of wooden ships. Since then turpentine and rosin have become the major products. Today the predominant uses are for paper and paper size, chemicals and pharmaceuticals, ester gums and synthetic resin, soaps, paints, varnishes, and lacquers.

Turpentine and rosin can be obtained by processing the crude gum that exudes when living trees are wounded, by distilling stumps and other resinous portions of dead trees, and as by-products of the sulphate pulping process. This discussion will be confined to the working of living trees for the so-called "gum naval stores," and will review evolution in woods practice, its effect on forest resources, and a glimpse of future possibilities.

Evolution in Woods Practice

An early method of production consisted of blazing trees and later returning to scrape off exuded droplets of gum. In time the colonists developed a practice of chopping from two to four holes or "boxes" in the base of each tree. At weekly intervals laborers returned to freshen or "chip" the upper margin of the wounds. Exuding gum drained into the boxes to be "dipped" at longer intervals. When the "faces" reached a height of 5 or 6 feet, new trees were boxed. As timber supplies dwindled, faces lengthened, sometimes to heights of 15 feet. Succeeding generations developed various tools to ease the tasks of boxing, chipping, and dipping, but the general practice continued without a major change until the beginning of the present century (5).

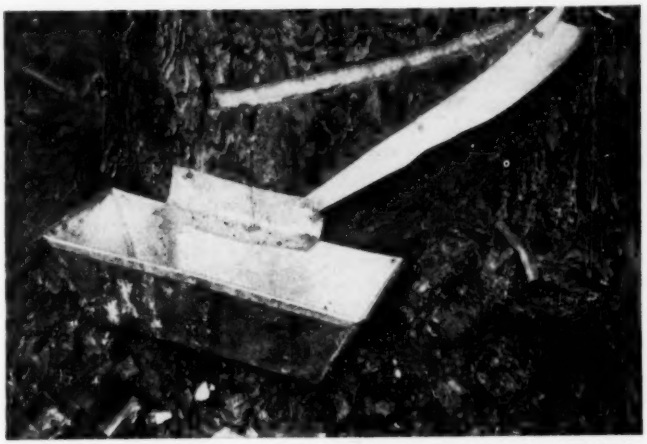

FIG. 1.—Modern method of turpentining, showing the initial streak for a bark-chipped, acid-treated face. Spiral gutter, formed to shape of the tree, and short apron are attached with double-headed nails to insure easy removal and re-use at a later date. Large 2-quart cup reduces frequency and cost of dipping by one-third. Below the new streak, note the absence of slabbing or broadaxe incisions; such old-fashioned practices reduce gum flow as much as 25 percent below that possible with modern methods.

In 1904, Dr. Charles Herty introduced the cup and gutter system. This development, still in use today, did much to improve the poor grade of gum and excessive waste associated with chopped boxes. Furthermore, small trees could be worked with cups and gutters, a feature that enabled gum producers to span the gap between disappearance of virgin timber and development of second-growth stands. But turpentiners continued to chip "knee deep and belly wide" because they believed inch-deep cuts into the wood made trees "bleed" better.

Conservative chipping and preservation of young trees became the next milestones. Beginning in 1910, personnel of the Florida National Forest demonstrated that conservative chipping methods would sustain high yields, lengthen the working life of faces, and greatly reduce mortality associated with destructive turpentining practice. With this improvement the industry began to abandon its earlier nomadic habit in favor of continuous turpentining at permanent locations.

In succeeding decades, research members of the U. S. Forest Service proved that trees less than 9 inches in diameter at breast height could not be worked at a profit unless gum prices were high. At the time nearly one-third of all trees being turpentined were of smaller size. Today very few small trees are cupped, a result brought about since 1936, largely through the Naval Stores Conservation Program.

The latest development, one already accepted by more than one-quarter of the industry, is bark chipping and acid treatment. This technique was discovered by the Russians, improved at the Lake City Research Center, and placed in commercial use in 1946. It promises to be a real benefit to an industry plagued by labor shortages, declining production, and increasing competition. In 1951,

[1]Paper presented at a meeting of the Division of Silviculture, Society of American Foresters, Biloxi, Miss., December 14, 1951.

acid users conserved one-quarter million man-days of labor with an estimated saving of a million dollars. This saving can be multiplied by four when the technique is in full use.

In the new technique, faces are freshened by removal of a ⅝-inch wide strip of bark. No wood is removed. The new streak is sprayed immediately with a 50-percent solution of sulfuric acid. Less than a small thimbleful of acid is sufficient. Streaks treated in this manner produce 50 to 100 percent more gum during the first week, and continue to yield above normal quantities during the second and third weeks after chipping. Consequently, about the same total yield per season can be obtained from bark-chipped, acid-treated streaks made at 2-week intervals as from untreated-wood streaks made at weekly intervals.

Bark streaking, an easier chore than wood chipping, has another advantage in that it preserves the normal round contour of the tree trunk. By using removable fasteners, such as Hyde tacks or double-headed nails, the entire bole of a worked-out tree remains suitable for lumber or pulpwood (Fig. 1).

Woods practice has been influenced also by changes in processing methods. In Colonial times, crude gum went to northern or foreign ports in barrels for processing. Consequently, boxing was done near navigable streams. In 1834 introduction of inexpensive semi-portable copper stills from the Scotch liquor industry enabled turpentiners to exploit all portions of the gum belt. During the following century most producers processed their own gum, and five crops[2] of boxes was considered to be a minimum economic unit for a direct-fire still. Then, development of steam distillation by the Bureau of Agricultural and Industrial Chemistry revolutionized processing methods. As a result 33 steam stills now process gum formerly handled by hundreds of fire stills.

Other factors, mostly economic, have reduced the size of woods operations. Today 89 percent of the industry's 8,863 producers work less than one crop each (*4*). However, the larger operators still produce 61 percent of the gum.

[2]10,000 working faces constitute a crop.

Effect on Forest Resources

The first alarm over the effect of turpentining upon the forest resource appears to have been sounded in Massachusetts in 1715. In that year boxing of pine trees on Cape Cod for the drawing of turpentine was forbidden by law. But in North Carolina, virgin stands beckoned, and the industry centered there for the next century and a half. Colonial producers often purchased a small tract and then made use of six to ten times as much of the surrounding area (*6*). In later years leasing of timber rights, usually for a 4-year period, became the accepted practice.

For a time, worked-out trees were felled for "tar wood," but in general, lumbering followed turpentining. Slack lumber markets resulted in abandonment of much timber, and high winds, fire, and disease exacted a heavy toll in trees weakened by deep chipping and broad-axe incisions (*1*).

The gum naval stores industry reached its peak in 1908. The decline thereafter was due largely to dwindling resources. Woods practice probably reached its lowest ebb before and during the depression, when one-third of the faced trees were too small for later utilization as sawlogs. A 1934 survey disclosed that turpentining in Georgia resulted in a net annual loss in volume of 2 million cords (*3*). The annual loss in jump butts alone was estimated at 50 million board feet. Since then many worked-out trees have been salvaged for pulpwood, although fire-scarred, nail-studded jump butts remain unmerchantable.

Exhaustion of virgin timber, followed by rapid destruction of second-growth stands, created much alarm over the availability of timber for future turpentining. But the combined effects of a 50-percent decline in gum production, more conservative chipping, and better fire protection preserved an adequate supply (*2*).

Future Possibilities

The pattern of the future is being shaped by pressure from other industries for labor, timber, and markets. Large operators of leased naval stores timber are being squeezed most severely. Their combined contribution to annual production has declined from three-fourths to only one-third of the industry's total output. Small gum farmers soon may be in the most favorable position because turpentining can be fitted into other farming, their costs of production are less, and trees can be rested if prices are unfavorable.

Although other industries are competing intensely for wood supplies, sufficient timber can be obtained for naval stores by integrating gum production with other forest uses. But producers must convince landowners that careless and destructive methods of turpentining have been discarded. Bark chipping and acid treatment do not degrade trees for subsequent utilization as poles, sawlogs, or pulpwood. Commercial tests show that gum can provide 25 to 40 percent of the net annual income on integrated operations.

Selective cupping, a practice in which turpentining is confined to trees marked for removal in the next cut, is a promising way of integrating naval stores with timber production. For two centuries, timber cutting in the gum belt has been a salvage operation after turpentining, but now turpentining is becoming a preliminary to planned and scheduled cuttings in managed forests, as demonstrated on the Olustee Experimental Forest.

Markets are influenced by cost of production, a factor closely related to the gum industry's low output per man, per tree, and per acre. The output of each chipper can be almost doubled by using sulfuric acid on a 14-day chipping schedule. Production has been aided further by improved equipment such as 2-quart cups, spiral gutters, acid applicators, bark hacks, and bark pullers.

The most promising long-range improvement is in development of a superior strain of high-yielding

pine trees. A few years ago scientists found 12 trees with gum yields two to three times greater than those of average trees. Controlled breeding experiments at the Lake City Research Center produced enough progeny to establish two plantations. Soon these seedlings will be large enough for tests of their gum-yielding capacity. If the results are favorable, gum may someday be produced in plantations containing 200 or more high-yielding trees per acre. Then producers can work seven times as many faces per acre as are now being turpentined in unimproved wild stands. Such a change would benefit the chipper, who now wastes much of his time walking from tree to tree. It would facilitate dipping, and make possible the development of more efficient techniques for harvesting gum.

The possibilities for developing strains of slash and longleaf pine which are superior, not only in gum production but also in growth rate, form, and other timber-tree characteristics, have scarcely been explored. This is one of the most clear-cut opportunities now known for further research in forest genetics.

The foregoing practices and developments indicate three major trends in the gum industry of the future.

1.—Use of extraction methods that permit integration with other forest products on intensively managed woodlands.

2.—Permanent production by small landowners who integrate turpentining with other farm work.

3.—Plantations of superior strains of high-yielding trees where mechanized and highly efficient methods of gum extraction may be used.

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Observations on Forestry Practice in Scandinavia[1]

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The productive forest area of Norway is about 19 million acres, 70 percent of which is coniferous and 30 percent deciduous forest. The total volume in the Norwegian forests is estimated to be 11,400 million cubic feet, and the annual net increment, allowing for losses through natural mortality, fires, etc., is about 357 million cubic feet. Thus the annual net increment over all the Norwegian forests is about 3.1 percent of the total growing stock.

In the year 1948-49 the total cut amounted to 392 million cubic feet, or 35 million cubic feet more than the estimated growth. One of the main reasons for this over-cut is the tremendous demand for timber in the domestic market for rehabilitation purposes; another is that wood products is one of the main businesses of the country and brings in much needed foreign exchange. Of the 392 million cubic feet cut, 21 million cubic feet was sold domestically as fuelwood, 98 million cubic feet was consumed on farms, and 273 million cubic feet was sold in the log form for remanufacturing. Of the latter, about 50 percent went to the pulp mills and 50 percent to sawmills.

The total area of forest land in Sweden is about 55 million acres, and the annual production from the forests is about 1,700 million cubic feet, of which a volume equivalent to over 5 billion board feet is consumed by the sawmill and pulp industry, the remainder being used for fuelwood, charcoal, soft and hard boards, and the wood distillation industries.

The ownership pattern of Scandinavia's forests is interesting in that in Norway 80 percent is privately owned, 14 percent is owned by the states, and 6 percent is in communal forests; and in Sweden, 75 percent is private, 19 percent state, and 6 percent communal. Scandinavia has the highest percentage of forest land privately owned of any forest country in the world, and in my opinion, their forest practices are among the best to be found anywhere.

History

The history of the development of forestry in the two countries is almost identical, and in a great many respects is similar to our own. In the early days, when timber had relatively little value, and the population was small, no particular attention was paid to the way in which the woods were handled. Only the finest lumber trees were cut. As export markets developed for sawn products, a greater and greater drain of the best material in the forests took place, but the first really heavy inroads on the forests were made in connection with the iron industry.

During the 17th and 18th centuries, the iron industry reached its zenith in Scandinavia. Great quantities of charcoal were used in

[1]Adapted from a paper presented at the annual meeting, Western Forestry & Conservation Asso., San Francisco, Calif. Dec. 6-8, 1950.

the smelting process, and as there is no coal in Sweden or Norway, the forests supplied the demand. During this period great estates and the larger companies were developed and had acquired vast acreages of forest land for the production of charcoal, but around the first of the 19th century many of the iron mines were depleted, and the sawmill industry was coming into its own. At about the same time the countries realized that their timber resources had not only become more valuable, but had been badly depleted. As a result, a general interest, both public and private, was created in the preservation of the forest. Prior to this there were isolated cases of good forestry—especially on the large family estates, but these had been managed on the classical German lines, which now have little or no place in the modern practical forestry in vogue throughout Scandinavia. Generally speaking, however, the development of modern forestry and legislation governing forest practices have taken place over the past 100 years.

Silviculture

The guiding principle throughout Scandinavia seems to be to extract the maximum growth capacity of the soil in the form of wood. All silvicultural activities are influenced by the main object of maintaining the yearly production of wood on any particular acre and site at the highest level economically obtainable throughout the life of the stand. This object is attained through careful attention to the adequate establishment of a new crop immediately following the final "regeneration cutting" of the stand, and then after the new crop is established, by frequent and light thinnings throughout its life. Usually the first thinning or "cleaning" is done at the age of 15 to 25 years depending on site quality and density of stand. This is the only thinning operation which does not show a return for the labor and money expended. From this point on, thinnings are made every 6 to 15 years, and the products of the thinnings are all usable—in the earlier years as fuelwood, charcoal wood, and pulpwood, in the later years as pulpwood and sawlogs. The final cut produces veneer logs and sawlogs from the lower part of the tree and pulpwood from the upper part.

One finds a considerable divergence of opinion as to how this ideal objective may be attained. The Scandinavian foresters are identical to our own in this respect! One forester may argue for natural regeneration, another for planting or seeding; one forester may argue for slash burning on certain sites, another against.

Generally speaking, however, certain broad silvicultural principles have been developed and are more or less accepted practice. For example, on the better sites, it is general practice to plant, rather than wait for natural regeneration. There are several arguments advanced for this procedure, among them being uncertainty of good seed years for natural regeneration, encroachment of heavy grass and brush on good sites, thus tending to retard natural restocking, and the fact that increased production and saving in time on plantations result in a monetary return from wood production at the end of the rotation which more than offsets the initial cost disadvantage of planting. In fact, certain foresters have made very elaborate investigations regarding the relative merits of natural regeneration and seeding and planting. Almost without exception they agree that planting on the better sites is the best procedure.

Forest genetics has been developed to a relatively high degree during the past 20 years because established industries have a capacity greater than the present forests can sustain. In order to obtain more wood for the industry, it is necessary to develop fast growing and better formed trees. Optimum growth has practically been reached with the strains already occupying the land. Some very intensive work towards improving strains has been done and the results so far seem to be very encouraging. In Sweden particularly surveys have been carried on over a number of years to determine where the best trees can be found. Such trees or groves are set aside for seed production purposes. The cones from these groves are very carefully gathered, and the seedlings are very carefully culled, so that those showing poor growth or poor form are eliminated before they are ever planted in the forest.

A considerable amount of work on grafting of forest trees is beginning to show encouraging results.

Loss from fire is practically unknown in Scandinavia. Norway for many years has had insurance on standing timber, through a company organized and operated by an association of forest owners. In practically all cases landowners who have insured standing timber have the benefit of insurance in perpetuity without any further premium payment. This fire insurance operates in the same way as a paid-up life insurance policy, and the reason that these policies are paid up is that there have been practically no losses from fire.

Losses from insects are in about the same category as losses from fire. While losses from decay are still in evidence, they are relatively small. All stands are composed of growing, healthy trees and decay has not had the opportunity to work as it does in the over-mature stands of North America.

As stated above, thinning practice calls for going over the stand every 6 to 15 years, but no classical thinning system such as thinning from above or thinning from below is followed. The main object is to develop in the stand for the final cut trees which are of good form, show good growth and good spacing, and are relatively free from limbs. Their guiding principle seems to be the removal of all trees, through successive thinnings, which do not show good quality. These trees may be either suppressed, intermediate, or, in some cases, dominant wolf trees. As a result of this procedure, thinning also is extremely flexible, and one of the greatest pleasures enjoyed by foresters in Scandinavia is to get together in groups on field days, go through a stand and have interminable arguments as to whether

a tree should be marked for cutting or left until the next thinning period. The principles followed are generally the same, but one finds many borderline trees about which these interesting arguments may be had.

The guiding principles in silviculture are, first, to maintain the maximum growth capacity of the soil throughout the rotation period; second, to obtain adequate regeneration either through planting, seeding, or naturally as soon as possible after the removal of the old stand; third, to strive always towards improvement of the quality of the stand, and fourth, through development of forest genetics to improve the strain of Scandinavian forest trees.

Logging

Logging practices in Scandinavia are extremely simple. Practically no mechanical equipment, as we know it, is used there. Most of the felling is done by hand, although of late years more and more power saws are being used. The wood is cut into uniform lengths and skidded by horse to hauling roads. The logs are then loaded by hand on small wagons or sleds and hauled by horse to the river banks for driving or to the main haul roads for trucking to the conversion plants. This has been the system employed for centuries and there is very little change in it, although gradually more wood is being hauled by road during the summer season. Equipment is extremely expensive in Sweden. All equipment has to be imported, and the relative cost of labor is considerably less than what we experience on the West Coast.

In Scandinavia, topography is quite favorable to logging. At no time during our three weeks in Sweden did I see any ground where a horse could not be worked. Another logging advantage is the system of waterways throughout the length and breadth of the country; these waterways offer the cheapest possible type of transportation. All wood down to a minimum diameter of 2½ inches is utilized either for pulp, sawlogs, or veneer logs. Smaller material is used for fuelwood and in a great many cases, for charcoal.

The logs are marked in the woods, first for sawlogs and veneer logs, second for sulphate pulp, third for sulphite pulp, and fourth for the forest owner. When the logs are driven down the rivers, sometimes 30 to 40 different ownerships will be driven at the same time. The logs are then sorted at the mouths of the rivers according to ownership and use, so that it is possible to have at one time something like 140 to 150 different segregations of logs being made at a central sorting works.

Utilization

The two main species are Scotch pine and Norway spruce. Both are used in the manufacture of pulp and for sawlogs. In all the larger companies we visited, we found completely integrated manufacturing. Most of them had veneer plants, sawmills, sulphate pulp plants, and sulphite pulp plants. Some of them even use unbarked softwood and hardwood in the manufacture of sulphate pulp. These industries also manufacture many products from the waste liquors developed in the pulping process. The manufacture of alcohol from waste sulphite liquor is a major industry. In Sweden and Norway a considerable quantity of such alcohol is served on the tables in the form of the famous Scandinavian drink "Aquavite." As stated above, the utilization of wood is very close because the volume of wood from the forests has about reached its maximum, and the demand is very high. These two factors have tended to stimulate research in all lines of forest products.

Administration

The systems of administration of forests in Norway and Sweden are generally very similar. All forest administration, both public and private, comes under the Board or Ministry of Agriculture, and the Minister of Agriculture is an elected official. Under him are divisions dealing with state and private forestry.

In Sweden under the Minister of Agriculture, the State Forest Service administers the state forests comprising 19 percent of the total forest area, or 10,000,000 acres; and the Royal Board of Private Forestry administers the forest holdings of farmers and private estates comprising 50 percent or 28,000,000 acres, those of companies comprising 25 percent or 14,000,000 acres, and those of communities comprising 6 percent or 3,000,000 acres.

The forest service is divided into several departments, having to do with forest administration, agriculture, technical forestry, sales, forestry education, accounting, and personnel. In addition, a company, known as the Swedish State Forest Industries Ltd. is owned by the forest service, although this company is economically independent. It buys all its wood from the state forests, it owns and operates sawmills, pulp mills, board plants, and wood distillation plants. It sells its products domestically and on the export market in direct competition with private industry. The company was formed in 1941 and is now by far the largest producer of sawn goods in Sweden, being responsible for an annual production of 195,000 standards or about 190,000,000 board feet of lumber. The activities of this state company are increasing every year, and it is causing considerable concern in private forest industry circles because it is in direct competition with them for raw material which is insufficient to supply present manufacturing capacity. In fact, the company enjoys an advantage so far as public wood is concerned, and it has certain advantages with regard to taxes.

The Swedish Forest Service, in addition to its task of growing trees on state lands, is engaged in the business of logging. During peak activity it employs about 20,000 woods workers and at the lowest point employs 8,000 men. This force is engaged in the business of extraction of wood from the forest, and the forest service sells the wood on the river banks to the converting industries. As a result of these activities it is the largest employer

of woods labor in Sweden, and is a very influential member of the Swedish Forest Employers Association, the organization responsible for the negotiation of contracts regarding wage rates and working conditions for the Swedish forest industry.

The Royal Board of Private Forestry, mentioned above, is responsible for the administration of forest laws governing all forest lands except those belonging to the state. Under the headquarters Board in Stockholm are organized 25 local forest conservation boards on the county level. These county boards, consisting of 3 to 5 members, are usually made up of local residents representing forest and agricultural organizations and forest land owners. They, with their technical staffs, help and advise the smaller forest owners as to the best methods of handling their woodlands, in addition to undertaking planting, education, planning of forest roads, and drainage systems, making working plans, controlling logging, and other measures. The county boards are also responsible for seed collections and extraction, the production and distribution of seedlings, etc.

The general system of administration of private forestry appears to work very satisfactorily. Its authority is on the *local* level and not on the *national* level. This allows great flexibility in the methods employed to suit varying local conditions. The large companies, of course, have their own forestry staffs, and the local forestry boards do not worry about their activities because the forestry practiced by the large companies is among the best to be found in Sweden. There, as here, the poorest forestry is found on the small farm holdings, and this is where the local boards spend most of their time in advice, education, and control.

Legislation

The gist of all the Swedish forest legislation can be summed up in the first paragraph of the Swedish Forest Conservation Law of 1949: "Forest Land; together with the forest growing thereon, should be managed in such a way as to further a suitable use of the wood-production capacity of the soil, ensuring a satisfactory economic profit and, as far as possible, a constant yield." In this law, the principle of profit is set forth. No forest owner can be forced to carry on any forest activity which will not show him a reasonable profit.

This same law provides that immature forests must not be cut except by thinning, and any such thinnings made, must be suitable for the proper development of the forest.

The overriding principle throughout the law is one of flexibility. Only general principles are laid down, and no specific methods for accomplishing objects are mentioned.

The government provides for subsidies for certain classes of forestry work, such as road building, drainage programmes, etc., which acts as a spur for forest owners to improve their properties.

Of course, the Scandinavians have taxes, just as we do; these taxes are more onerous than our own, but they are still growing trees and making a profit at it.

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Ground Cover Requirements for Summer Storm Runoff Control on Aspen Sites in Northern Utah

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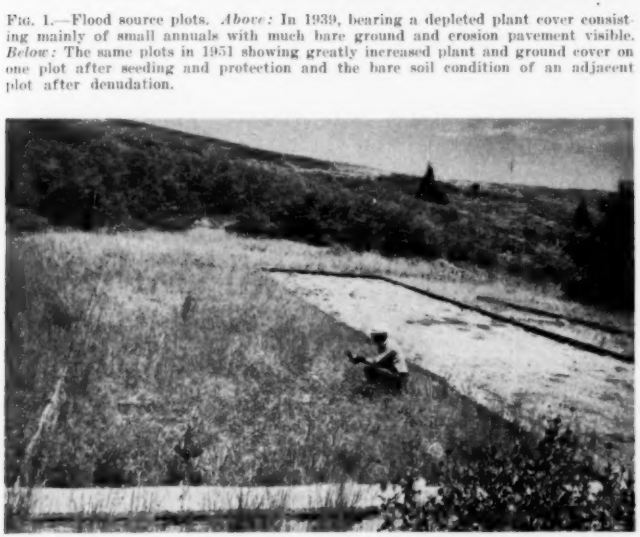
Foresters have long recognized that living plants and litter generally minimize overland flow and erosion. The specific degree to which the ground surface on forest and range lands should be kept covered by vegetal material to prevent excessive storm runoff and accelerated erosion, however, is not so well known. Lack of this information is in fact one of the major obstacles to effective watershed management in the Intermountain Region.

In 1936, a plot study of the effects of different amounts of plant and litter cover on overland flow and erosion was initiated on the upper slopes of the 2,000 acre Parrish Creek watershed near Farmington, Utah. Results of this study over the period 1936 to 1949, inclusive, are here reported because they shed light on the amount of ground cover which appears to be necessary for watershed protection purposes on the steep, humid mountain lands of northern Utah.

FIG. 1.—Flood source plots. *Above:* In 1939, bearing a depleted plant cover consisting mainly of small annuals with much bare ground and erosion pavement visible. *Below:* The same plots in 1951 showing greatly increased plant and ground cover on one plot after seeding and protection and the bare soil condition of an adjacent plot after denudation.



PARRISH CREEK, like some other nearby high gradient streams draining the steep west face of the Wasatch Mountains, produced several destructive mud-rock floods in 1930 (*3*). The source of these floods was found to be localized areas on the headwater slopes where the herbaceous and shrubby plant cover had been greatly depleted, mainly from overgrazing by livestock (*1*). Beginning in 1934, the flood-producing watersheds in this locality were closed to grazing and in several of the watersheds the depleted and eroding flood-source areas were contour trenched and seeded to grass. This treatment, where intensively applied, has proved to be effective in preventing the recurrence of mud-rock floods (*2*).

Concurrently with the contour trenching work in the Parrish Creek watershed, several plots equipped to measure surface runoff and erosion were established on sites representative of flood-source and nonflood-source conditions. Records of rainfall, runoff, and erosion during the summer season (July-August) along with inventories of the plant cover were started in 1936 and continued annually. The plots were not disturbed during the period 1936 to 1946 but in 1947 the plant cover was altered on several of the plots.

Flood-source plots.—Six 1/40-acre runoff plots were installed on a 2-acre, depleted, weedy area that was surrounded by aspen (*Populus tremuloides*) forest (Fig. 1). Plant cover on these plots in 1936 was composed mainly of the annual knotweed (*Polygonum douglasii*) and kitchen weed (*Gayophytum ramosissimum*). Average ground cover—live vegetation plus litter—was about 4½ percent. The soil was a light brown, compact, sandy loam. The soil surface was distinctly rill marked and partly covered with a gravelly erosion pavement, clearly indicating the area to be a source of overland flow.

Two of these flood-source plots were located at the edge of the weedy area near the bordering aspen forest. By 1946 the average ground cover on these plots had increased to about 55 percent, mainly because of spotty encroachment of aspen shoots. In 1947, grass seed was scattered over the larger bare spots and by 1949 the average ground cover had increased to about 80 percent.

In the spring of 1947, two other plots were seeded to grass and mulched with straw. Before treatment they had an average ground cover of 16 percent. By 1949 much of the straw mulch had disappeared but the new grass plants had thickened enough to provide a ground cover of about 64 percent.

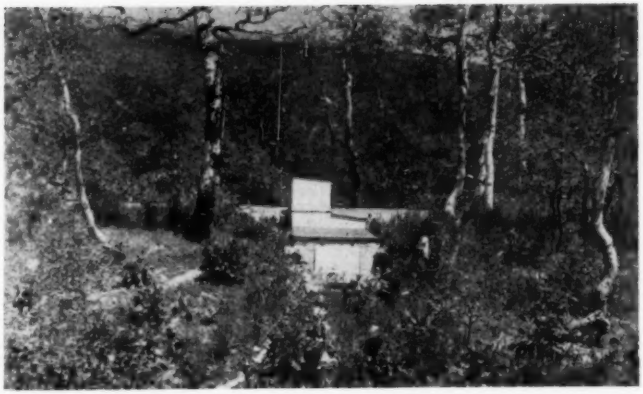
Also in 1947, the two remaining weedy plots were denuded of both plants and litter by burning with a torch. The average ground cover of 8 percent on these plots in 1946 was thus reduced to and kept at zero during the summers of 1947, 1948, and 1949.

Nonflood-source plots. — Four larger runoff plots (1/10-acre) were located in the aspen forest stand adjacent to the weedy flood-source test site (Fig. 2). Plant cover on these plots in 1936 consisted of an overstory of aspen and a sparse understory of herbs. There was a thin but well distributed layer of litter composed mostly of aspen leaves. This, combined with the live vegetation, provided an over-all ground cover of about 60 percent. The soil was a dark brown sandy loam with a crumb-like structure. There were no rill marks or other evidence of accelerated erosion or of excessive storm runoff on these plots.

Beginning in 1936, under protection from livestock grazing, the herbaceous understory on these plots rapidly increased in volume. Total ground cover, however, increased only moderately because of the rather complete cover of litter at the start of observations.

In the spring of 1947, all vegetation—both aspen trees and herbaceous plants—and all litter were removed on one of the nonflood-source plots by cutting and burning. Total ground cover, which was 81 percent on this plot in 1946, was thus reduced to zero for the years 1947-49. On another plot, all aspen was cut and removed but the herbaceous vegetation and litter were left in place. This treatment did not change the percent of ground cover, though there was a thickening of the herbaceous plants. Total ground cover remained at 83 percent during the years 1947-49.

The other two nonflood source plots were not disturbed. They had an average ground cover of 81 percent in 1946 which, by 1949, had increased to 88 percent.



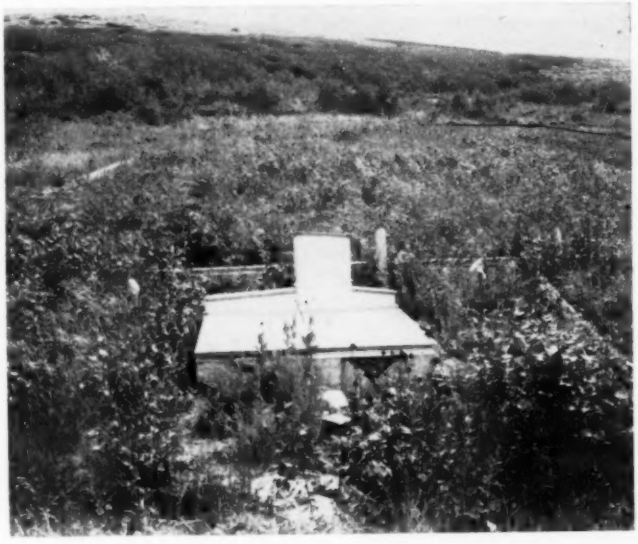


FIG. 2.—Nonflood source plot. *Above:* In 1939, showing aspen cover with sparse understory of herbaceous vegetation. *Below:* The same plot in 1949 after removal of aspen showing dense cover of herbaceous vegetation.

Summer storms.—During the period of study, a total of 146 summer storms were recorded at a climatic station near the study site, or an average of about 11 storms per summer. The amount per storm averaged 0.30 inch and varied from 0.01 to 3.90 inches. The average amount of summer rainfall per year was 3.09 inches though actual amounts ranged from 0.10 inch in 1944 to 7.58 inches in 1948.

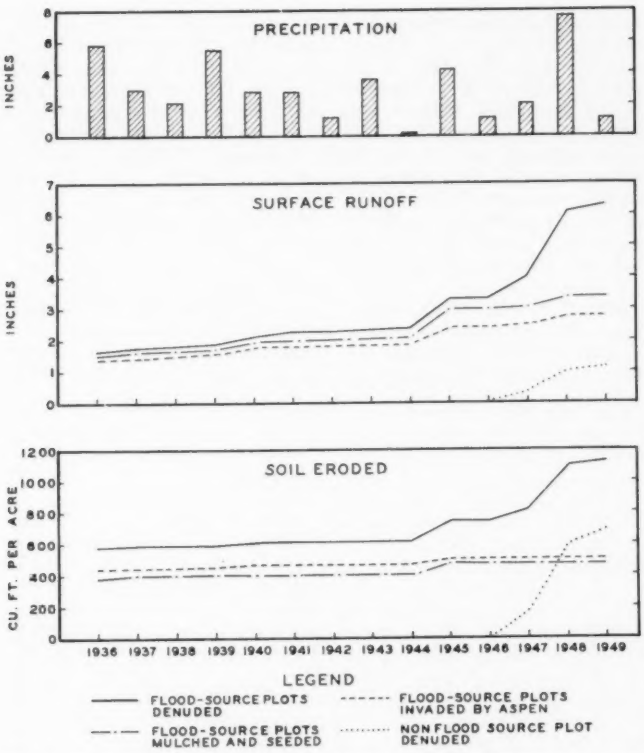


Fig. 3.—Total summer precipitation (July-August) and accumulated surface runoff and eroded soil, Parrish plots, 1936-49.

Summer rainfall on the study area generally averages only about 10 percent of the annual total, the rest occurring mainly as snow during the winter. During the summer season, following the disappearance of snow, the soil mantle develops up to 6 to 12 inches of storage capacity because of evapotranspiration losses. With the small volume of the summer rains in relation to the amount of mantle storage, summer rainfall does not contribute to runoff except when rainfall rates exceed infiltration rates and thus cause overland flow.

The summer storms are of short duration but commonly attain high intensities during brief periods. Maximum 5-minute rainfall rates were recorded during 113 of the 146 summer storms. These records show that 94 of the storms, or an average of about 7 per year, attained maximum rates of less than 1.50 inches per hour. In 15 storms, or an average of about one per year, rates varied from 1.50 to 2.99 inches per hour. During four storms, or an average recurrence of once every 4 to 5 years, rates exceeded 3.00 inches per hour. In the latter group the rainfall rates varied from 3.6 to 6.84 inches per hour. Still greater rainfall rates —up to 8.40 inches per hour—have been recorded at other gages in the vicinity of the study plots (*4*).

Effective storms. — During the period of study 36 of the 146 summer storms caused runoff from one or more of the plots. The minimum amount of rainfall that produced a measurable quantity of runoff was 0.15 inch and the maximum was 3.90. Rainfall rates were obtained during 29 of these 36 effective storms. During 13 of these storms of record the maximum 5-minute rate was less than 1.5 inches per hour and the minimum effective rate was 0.24 inch per hour during a 5-minute period. In 12 of the storms the maximum rainfall rates varied between 1.56 and 2.88 inches per hour. For the other four storms, the maximum rates for 5 minutes were 3.60, 4.32, 5.04, and 6.84 inches per hour.

Of the 36 effective storms, 23 caused some soil erosion from one or more of the plots. The minimum amount of rainfall that caused soil erosion was 0.28 inch during which storm the maximum 5-minute rate was 1.80 inches per hour. The minimum rainfall rate that caused soil erosion was 1.08 inches per hour which occurred in a storm with total depth of 0.37 inch.

Treatment Effects

The runoff and erosion behavior of the plots varied greatly during the period of study. Some of this variation occurred during the period 1936 to 1946 as a result of natural changes in ground cover conditions. Still greater changes in runoff and erosion behavior occurred on some of the plots following their treatment in 1947 (Fig. 3).

Flood-source area behavior.— During the first year of record all of the flood-source area plots had uniformly small amounts of ground cover and yielded large amounts of runoff and eroded soil. They also yielded substantial amounts of runoff and soil loss in 1945. These plots exhibited radical differences in their behavior, however, following treatment in 1947.

Least runoff and erosion occurred on the two weedy plots that were invaded by aspen. Between 1936 and 1946, when the average ground cover on these plots increased from 6 to 55 percent, runoff averaged 0.22 inch and soil loss averaged 45.8 cubic feet per acre per summer. Between 1947 and 1949, when ground cover averaged 84 percent, these plots yielded only 0.12 inch of surface runoff per summer or about one-half as much as formerly. During this latter period, these plots lost no soil.

The two weedy plots that were mulched and seeded in 1947 pro-

duced an average of 0.27 inch of runoff and 43.7 cubic feet of eroded soil per acre per summer. During this period, average ground cover varied between 4 and 16 percent. After mulching and seeding, when ground cover averaged 74 percent, the runoff per summer was reduced to 0.13 inch or about one-half the pre-treatment rate. No soil was lost from the plots after they were mulched and seeded.

The two remaining flood source plots, which were denuded in 1947 yielded 0.31 inch of runoff per summer before treatment. During that time their average ground cover was between 3 and 8 percent. After all cover was removed they yielded 0.97 inch per summer or more than three times as much. Sediment eroded from these plots was 67.1 cubic feet per acre per summer before treatment and 132.3 cubic feet per acre per summer after denudation.

The behavior of these flood-source plots demonstrates that seriously depleted sites will continue to produce substantial amounts of storm runoff and to erode if they are kept in depleted condition. Improvement in control of runoff and erosion is likely to be slow on such sites except where there is an opportunity for encroachment of aspen or possibly by other types of perennial vegetation. The plots also demonstrate that a high degree of summer storm runoff control and soil stability can be achieved rapidly by seeding and mulching. Where sites have become deeply gullied as well as depleted of vegetation, it may be necessary to install contour trenches or other mechanical aids in order to insure successful revegetation.

Nonflood-source area behavior.—The two nonflood-source plots which were left in their natural state throughout the study exhibited no significant changes in runoff and erosion. Runoff from these plots was never more than 0.1 inch per year or more than 1 percent of any storm. Moreover, they never yielded a measurable quantity of eroded soil during the 14 years of study.

The nonflood-source plot from which the aspen trees were removed without disturbing the herbaceous understory or the litter yielded 0.005 inch of runoff per summer during the period 1936 to 1946 and 0.02 inch per year after treatment. Although this is a fourfold increase in runoff it is still an insignificant amount. This plot, like the two untreated plots, has lost no measurable quantity of soil either before or after removal of the aspen trees.

Runoff from the fourth nonflood-source plot during the period 1936 to 1946 averaged 0.006 inch per summer, and this runoff caused no measurable soil loss. During the summers of 1947 to 1949, after this plot had been denuded, runoff averaged 0.38 inch per summer and soil losses occurred at a rate equivalent to 230.2 cubic feet per acre per summer. During a single rain of 1.4 inches when rainfall rates attained a maximum of 3.6 inches per hour, this plot yielded about 30 percent runoff and lost the equivalent of 330 cubic feet of soil per acre. The effect of denudation on this plot can be more fully appreciated when it is considered that under normal plant cover conditions rainfall rates as of 6.84 inches

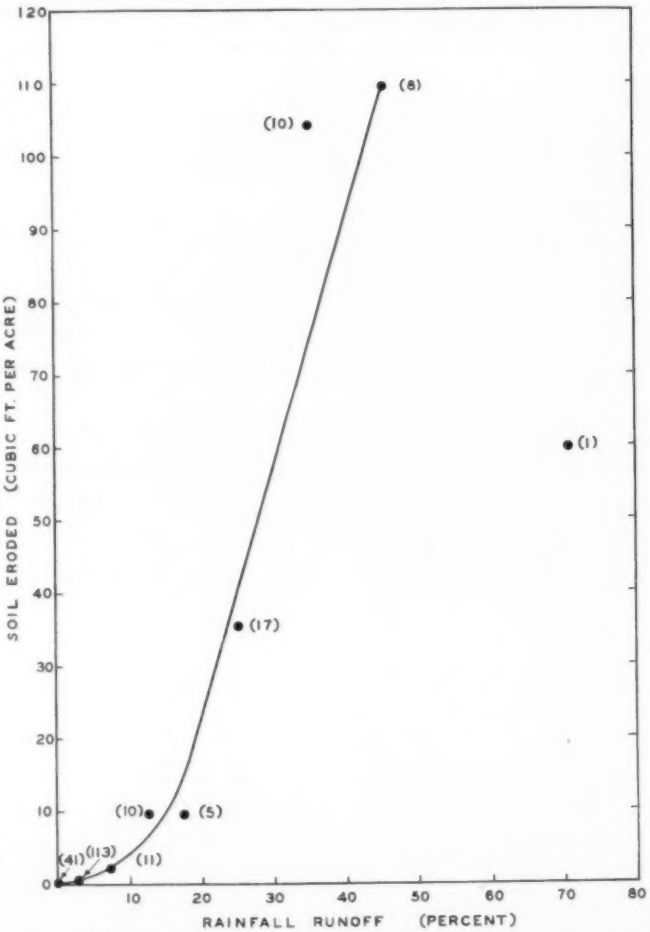


FIG. 4.—Relation of soil loss to summer rainfall runoff. Figures in parentheses show the number of observations for each mean plotting point.

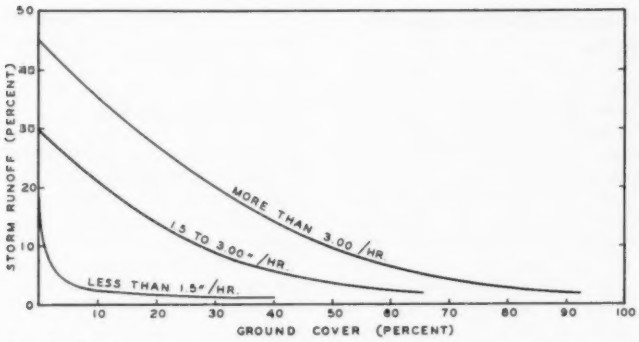


Fig. 5.—Relation of summer storm runoff to total ground cover under the impact of low, moderate, and high intensity rainfall rates.

per hour failed to cause any measurable amount of erosion; whereas, after denudation maximum rainfall rates as low as 1.20 inches per hour caused as much as 33 cubic feet of soil loss per acre.

The behavior of these plots clearly demonstrates that nonflood-source areas with stable soils can be converted to storm runoff and sediment source areas by removal of the vegetal and litter cover.

Protection Requirements

The 23 summer storms which were effective in causing some soil loss on one or more of the plots provided a total of 216 records from which to develop a relation between soil loss and rainfall runoff. This relation showed erosion to be negligible (less than 1 cubic foot per acre) when 5 percent or less of the rainfall ran off as overland flow but to increase rapidly with greater amounts of storm runoff (Fig. 4). Because stable soil is a first requisite in land management, 5 percent storm runoff appears to be the maximum allowable for watershed protection purposes on this type of land.

Variations in ground cover conditions on the plots during the period of study made it possible to develop relationships between amounts of storm runoff and ground cover under the impact of low, moderate, and high rates of rainfall. Under all three classes of rainfall rates, storm runoff decreased with increasing amounts of ground cover (Fig. 5).

These relationships show that storms in which rainfall rates do not exceed 1.5 inches per hour may cause up to nearly 20 percent runoff when the soil is bare but less than 5 percent runoff when 5 percent or more of the ground is covered. During storms in which maximum rainfall rates are from 1.50 to 3.00 inches per hour, there may be as much as 30 percent runoff under bare soil conditions; and 45 percent or more of the ground must be covered to prevent the occurrence of more than 5 percent runoff. During major storms, with rainfall rates in excess of 3.00 inches per hour, as much as 45 percent runoff may be expected from bare ground; to keep runoff during such storms to less than 5 percent requires a ground cover of at least 65 percent. A continuation of records on these plots may show that a somewhat greater proportion of the soil must be kept covered to cope with greater rainfall rates than have thus far been experienced. Two-thirds of a complete ground cover of living plants and litter, however, appears to be the minimum ground cover conditions required for effective protection on the herbaceous-aspen watershed lands in this locality.

The watershed protection requirements indicated by the behavior of these plots is in close agreement with results of other studies in the Intermountain Region. On steep grass range having a loose granitic soil in southwestern Idaho, for example, infiltrometer tests have shown that a ground cover of 70 percent is required for controlling storm runoff and erosion under the impact of 3.60 inches per hour rainfall rates (*5*). Similar tests on subalpine herbaceous range having heavy clay soil in central Utah show that a 70 to 75 percent ground cover is needed for effective control of storm runoff and erosion (*6*).

Attainment of an adequate ground cover and its maintenance under the pressure of demands for grazing use by livestock and big game pose difficult management problems beyond the scope of this study. A ground cover of at least 65 percent, however, appears to be a reasonably sound minimum requirement for watershed managers to strive for in handling the humid mountainous forest and range lands of northern Utah.

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Reforestation of Strip-Mined Bituminous Coal Land in Pennsylvania[1]

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In 1945, a "Bituminous Coal Open Pit Mining Conservation Act" was passed by the legislature of Pennsylvania which required all operators to reclaim land stripped for bituminous coal. This act called for rounding-off the spoil piles to permit planting of trees, shrubs or grasses and required that planting be carried out as soon as possible in accordance with a plan approved by the Secretary of Forests and Waters. Requirements were increased somewhat in 1949 by an amendment which called for planting of all land affected by stripping. Under this amendment, backfilling sufficient to plant the final cut has been required, and all disturbed areas are to be planted within a period of 3 years. A bond of $300 per acre is posted by the operator against carrying out the requirements of the act. Under the 1949 amendment an operator can, with the approval of the Secretary of Forests and Waters, pay the state $60 per acre in lieu of planting; this money is to be expended by the state for backfilling or planting.

Under the procedure set up by the Pennsylvania Department of Forests and Waters, a planting plan is made for each operation after leveling has been approved by the Department of Mines. Plans are simple, but contain the essentials necessary for the job—mainly the species and quantity of plants to be used. Much judgment must be used on the ground by the planting supervisor in fitting species to the sites to which they are best suited and in the details of planting. When the planting is complete, a planting report and map are filed with the Secretary of Forests and Waters on a form furnished by the state. The Department of Forests and Waters inspects the planted areas within a year after planting. Approval is based on planting in a "workmanlike manner" in accordance with the prescribed plan.

The extent of planting has grown in recent years from practically nothing in 1945-46 to about 5 to 6 million trees on spoil banks in 1950. About 5,000 acres have been planted to trees and shrubs by coal operators since the passage of the act in 1945, and an additional 2,500 acres have been reclaimed for farming or other uses. In 1950, the state embarked on extensive planting of areas stripped prior to passage of the act, and in that year about 6,000 acres were planted with trees, shrubs, or grasses.

When skilled supervision has been used in planting and care given to handling of trees, successful plantings have been made on all types of spoil except highly acid banks. Except for the dry year of 1946, the planting seasons since 1945 have been favorable ones. When unfavorable years occur, considerable replanting will be necessary; but in the average year, successful plantings can be made with well-developed planting stock of species that have been tested and found adaptable to the severe conditions found on spoil banks.

The Problem

A rapid increase in strip mining of coal, or open-pit mining as it is more properly called, has created a special planting problem of national importance in recent years (*1*). The total area involved in Pennsylvania is not particularly large, probably about 60,000 acres (*5*); but scattered as it is in parcels varying in size from a fraction of an acre to several hundred acres, it has become a prominent disfiguration on the landscape of a considerable portion of the state.

In the process of mining, topsoil is pushed aside with bulldozers and buried under overburden dug by power shovels as they uncover coal seams; the raw rock material from just above the coal is placed on top of the piles (Fig. 1). These piles of mixed soil and rock are left in long, parallel ridges, bare of vegetation and possessing many extremes of site conditions. The height of individual spoil piles and the size of any one spoil area depends primarily upon the depth to which an operation can go profitably, and the topography of the area. A common rule of thumb which gives a rough approximation of the depth of most opera-

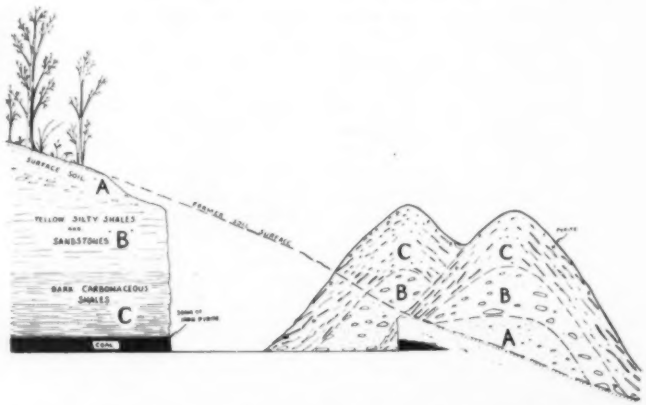

FIG. 1.—Creation of spoil banks. Material *A* is surface soil scraped aside with bulldozers; *B* is rock overburden removed by shovel and bulldozer combination and placed on top of surface soil; *C* is shale and roof-coal removed from above coal seam by shovel and placed on top of spoil.

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tions is a 12 to 1 ratio, or 12 feet of overburden removed for each vertical foot of coal. Coal seams in Pennsylvania are commonly 3 to 6 feet in thickness and usually produce spoil banks from 15 to 30 feet high. As these seams usually dip into hillsides, only one to three cuts each about 60 feet wide are commonly made, which leave spoil areas about 100 to 300 feet wide and varying in length from a few hundred to thousands of feet. Only in a few cases where entire hilltops have been removed does any operation affect more than 100 acres; ordinarily the spoil area created by a single operation does not exceed 20 acres.

Important Site Characteristics of Spoil Banks

Perhaps the most important features of spoil banks in relation to reforestation are the extremes of certain site conditions which commonly occur. These have been studied in relation to planting success and failure over a 5-year period and an understanding of them has been found necessary to successful reclamation.

Soil Acidity

As the material from immediately above the coal seam is usually thrown on top of spoil piles, a serious problem is created so far as plant growth is concerned, for in many cases the slate from above the coal, or the roof coal, and "boney" contain pyritic material which breaks down upon exposure to air to form sulphuric acid. Soluble alumina, also, is formed by reaction of the acid on shales and is harmful to plants. Spoil of entire banks or sections of banks where pyrite occurs may have a pH of 3.5, or less, and thus be totally incapable of supporting tree growth for a considerable period; certain banks have remained below pH 3.5 for 30 years. Fortunately, entire banks containing pyritic material are rare except in some few localities. Most banks in Pennsylvania possess a pH between 4.0 and 6.5, a condition which will permit survival of all but a few of the shrubs and trees tested to date. However, as even such banks commonly possess scattered spots of extreme acidity, it has been necessary to identify and avoid planting extremely acid spoil below pH 4.0. Neutral to alkaline banks (pH 6.5 to 7.5) are found in a few areas in the state where thin limestone, limey shale, or glacial till is present; massive limestone areas seldom have been mined.

Soil Content

In a typical spoil bank, the percentage of soil-sized material, that is, those particles less than 2 mm. in diameter, is relatively low. Surface material with a soil content of over 50 percent may be found on the outer edges of and in small spots within spoil areas, but the major part has a soil content of between 20 and 50 percent. This makes for high permeability and low water retention near the surface and materially affects plant survival. Areas with a soil content of over 20 percent have been successfully planted; but where the content is as low as 15 percent both tree planting and direct seeding have failed to give satisfactory survival even in normal years. Soil content also enters prominently into the success of fall planting through its effect on heaving, as will be brought out later.

Wind Exposure

Most spoil banks are exposed, in part, to the full sweep of wind from at least one direction. Although a direct effect of wind upon planted trees may be seen at times, more important are the indirect effects through its influence on transpiration and loss of soil moisture by evaporation. Exposed upland banks dry rapidly on their surfaces so that the moisture supply in the top 6 to 8 inches usually becomes critical in any dry period. This condition, coupled with a high transpiration rate, makes the use of strongly rooted planting stock necessary for adequate survival. Under such conditions direct seeding is an extremely hazardous method of reforestation and only tap-rooted species with large seeds, such as oaks, have given satisfactory results on upland shale banks, both in Pennsylvania and elsewhere (*2*). Also important are strong winter winds which cause foliage burning of conifers and winter killing. Because the first large losses usually have occurred during the first winter after planting, selection of wind-resistant tree species for planting both on crests of spoil piles and on exposed slopes is necessary. Hardy deciduous trees, such as native upland oaks and ash, have proved particularly suited for resisting winter desiccation on exposed sites.

Soil Temperature, Slope, and Parent Material

Certain factors become of vital importance to success of plantings under extremes of local conditions. Prominent among these are the extreme surface temperatures that occur on dark-colored spoil on southerly exposures and which are undoubtedly a critical factor on many spoil banks. Surface soil temperatures of 130 degrees F., which are not uncommon on spoil banks, are usually lethal to very young seedlings before their stems have formed corky bark. While such damage is not ordinarily shown by older seedlings from nurseries, a few cases of heat lesions have been observed on trees planted in grey shale. More important to planted stock, however, is a combination of the high surface heat with drought causing an excessive loss of soil moisture in surface layers. This combination has accounted for much of the mortality among trees during the first three years after planting.

Loose, sliding material on steep slopes makes them almost impossible planting sites except for large hardwood stock and certain shrubs. Slopes of over 70 percent are almost always poor risks for planting unless exceptional stability exists as in the case of some shales; but slopes up to that gradient have been successfully planted. This factor can be nearly eliminated for practical purposes by partial leveling; and on certain spoil types, particularly glacial till, such re-

duction of slope has been necessary to successful planting.

Intimately tied in with degree of slope is erosion, a particularly serious factor only on areas with a high percentage of soil. Shale banks with low soil content at their surfaces seldom show signs of erosion even when slopes are over 70 percent. Two slope conditions are commonly encountered that give rise to excessive erosion: (1), long, gradual slopes with a grade of approximately 30 to 40 percent created by leveling banks to original land contours, (2), steep short slopes with 70 percent gradient or more of unleveled banks and steep outslopes of partly leveled banks. When either condition exists along with high soil content, serious erosion usually occurs, causing high losses of planted material. One effective remedy has been either to level so as to avoid long slopes, or to put in contour ditches to break excessive surface flow. Also, on extremely steep hillsides, a type of leveling has been used which creates a bench that is usually sloped back towards the high wall.

The different types of substrata presented by shale, sandstone, glacial till, and limestone make specific consideration of the parent material important in reclamation. Mechanical difficulties in leveling and planting on sandstone spoil is but one example of the many problems caused by differences in parent material. Another is the extreme surface sliding and erosion typical of glacial till which makes careful leveling necessary.

Parent material also materially affects natural revegetation, especially where loose shale is present and a pavement consisting of an inch or more of shale fragments has developed. This layer acts somewhat as a stone mulch over the surface, reducing runoff and evaporation on one hand, thus conserving moisture, but on the other hand presenting a barrier to natural reseeding.

Natural Revegetation of Spoil Banks

The rapidity with which spoil banks are revegetated naturally varies considerably with the intensity of the factors outlined in the previous section; but in general, revegetation proceeds slowly on unleveled, upland banks.

This process has been studied in central Pennsylvania on unleveled, upland shale banks with a pH between 4.0 and 5.5. The typical pioneer community which develops has been designated as the aspen-fire cherry community (Fig. 2) and has as its characteristic tree species, aspen (*Populus tremuloides* and *P. grandidentata*), fire cherry (*Prunus pennsylvanicum*), wild black cherry (*Prunus serotina*) and red maple (*Acer rubrum*); and as characteristic shrub species, blackberry (*Rubus allegheniensis*) and dewberry (*Rubus villosus*). These woody plants invade the spoil banks within 2 to 3 years and are the pioneer plants on many areas. They are able to come in among shale and other rock fragments of the dry surface layer, often before herbaceous plants have appeared, to form a sparse woody cover composed of scattered groups, or individuals with bare spoil between. A thin herbaceous cover may also develop along with the pioneer trees and shrubs. This layer has as its common and characteristic plants poverty grass, various panic grasses, sedges, asters, goldenrods, hawkweeds, whirled loosestrife, cinquefoil, and barrens violet, all of which are typical weeds that invade poorer upland fields. On leveled areas and where soil content is high, the herb and grass cover is more prominent in the early stages of development; and may even be the first type of community, particularly where banks are surrounded by farmland lacking forest cover. In such cases a poverty grass-dewberry community may be fully developed before being superseded by aspen-fire cherry.

The amount of total cover that develops on typical upland banks is usually inadequate to hide the spoil piles. On most banks up to 10 years of age the cover has been less than 50 percent; and this period of relative barrenness has extended for 20 years or more on highly exposed banks composed of loose shale with low soil content. Lack of evergreen cover is particularly important, because in the winter with their sparse deciduous cover, the banks appear barren and ugly for many years. Artificial

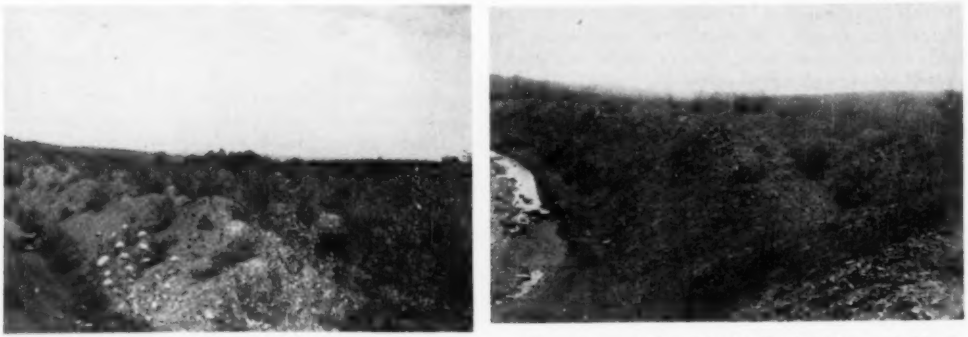

FIG. 2.—Summer and winter aspects of the aspen-fire cherry community on 10-year-old spoil banks. Total plant cover is 33 percent, and area is 55 percent stocked with trees which average 1,300 per acre.

planting of both hardwoods and conifers appears to be needed, both to furnish adequate deciduous cover and to add evergreen species.

The study also has shown that natural reforestation is very slow on typical banks and usually produces an inadequate, or barely adequate, tree cover for the first 10 to 20 years. For example, a stocked-quadrat study of 15 banks has indicated that up to 10 years of age the percent stocking, based on one tree per milacre, varied from 1 to 93 percent. Of the 15 banks studied, six were less than 40 percent stocked; six were 40 to 60 percent stocked, and only three were more than 60 percent stocked. The latter banks had been stripped so as to leave a rough, but nearly level, spoil condition that appears to be conducive to more rapid revegetation than when banks are left in peaked ridges. In total stand density, natural reforestation has produced 1,000 trees per acre in 10 years on half the banks studied. A similar natural reforestation has been reported in other states (*3*). Addition of better tree species can be carried out advantageously after natural revegetation has begun, usually in 3 to 5 years after stripping. This will permit filling in of open spaces at a time when some protective woody cover has developed.

Unfortunately, the trees invading the banks successfully were practically all of short-lived or less valuable species—aspen, fire cherry, and red maple. These trees have so deteriorated on older banks that wood production from them does not appear probable in the first generation. Conifers were almost totally absent; white pine was found on two banks and hemlock was recorded once. Of course, special cases do occur when parts of spoil banks have seeded-in with better pioneer species such as sycamore, yellow birch, black cherry, and even yellow-poplar, but these are almost invariably exceptions to the general pattern. Moreover, most if not all the banks over 20 years of age which have been covered adequately with trees are low piles possessing a high percent of surface soil and are not comparable to the spoil banks produced in recent years. Where black locust occurred, it invaded older spoil banks very aggressively and formed an important part of the pioneer tree cover. In fact, two of the banks over 10 years old with adequate tree cover had locust as a principal tree species. Unfortunately these banks are also exceptions to the general rule.

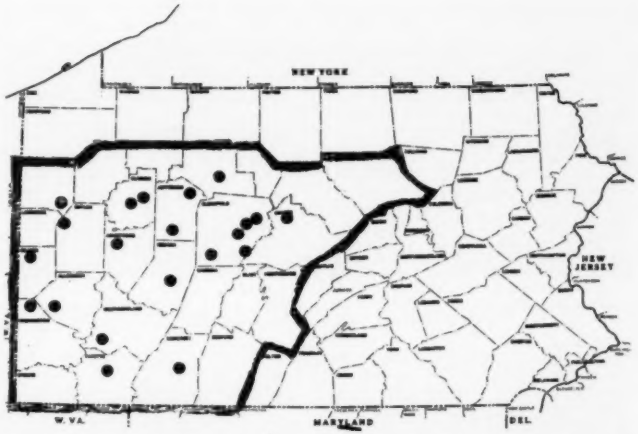

FIG. 3.—Distribution of test plantings (black dots) on spoil banks in the bituminous coal region of Pennsylvania (approximate boundaries shaded in black).

Survey of Older Planting on Spoil Banks

There are in existence in Pennsylvania a number of older plantings on spoil banks. These offer a valuable source of information, but do not answer all questions because most of the older operations did not go as deep as the modern ones; as a result, the spoil conditions are not comparable except in a very few cases. Moreover, most of them were not planted until some years after operations had ceased, while the banks resulting from present operations are often planted as soon as completed.

A survey and sample plot study made in 1947 of older plantings, 10 to 24 years of age, revealed that eleven species were growing successfully on spoil banks. The banks were acid shale and sandstone with a pH between 3.5 and 5.1 and covered a variety of gradients and aspects. No species had succeeded on banks with a pH below 3.5 and on slopes of loose material with a gradient of 70 percent or more.

Successfully established species were as follows:

Banks pine	*Pinus banksiana*
Pitch pine	" *rigida*
Red pine	" *resinosa*
Scotch pine	" *sylvestris*
Shortleaf pine	" *echinata*
Table mountain pine	" *pungens*
Virginia pine	" *virginiana*
White pine	" *strobus*
Japanese larch	*Larix leptolepis*
Norway spruce	*Picea excelsa*
Black locust	*Robinia pseudoacacia*

Spring Planting Tests

Twenty-three randomized block test plantings have been made over the past five years in 15 counties which cover the major spoil types found in the bituminous coal region of Pennsylvania (Fig. 3). Within the test blocks, each species was represented by 100 trees planted in five rows which ran perpendicular to the contours of the spoil. The species were located at random in each block. As shown in Table 1, the number of tests in which each species was represented on any one spoil type varied one to sixteen, so that the number of trees tested varied from 100 to 1,600 per species. In analyzing results, a survival of 60 percent or more has been considered good, 40 to 60 adequate, and below 40 percent unsatisfactory.

The results shown in Table 1

TABLE 1.—EARLY SURVIVAL OF TREES AND SHRUBS ON COMMON SPOIL TYPES IN PENNSYLVANIA. PLANTED 1946 TO 1950; COUNT TAKEN IN FALL, 1950

	Average Percent Survival by Spoil Types							
	Type I		Type II A&B		Type III		Type IV	
	Percent	No. Tests	Percent	No. Tests	Percent	No. Tests	Percent	No. Tests
Conifers:								
Banks pine	22	4	52	15	41	2	46	2
Pitch pine	42	2	40	16	29	2	48	1
Ponderosa pine	11	1	15	4	8	1	7	1
Red pine	23	1	68	9	—	—	69	1
Scotch pine	—	—	85	6	—	—	80	1
Virginia pine	—	—	92	1	—	—	—	—
White pine	35	3	50	15	54	2	23	1
Douglas fir	7	3	42	6	20	1	14	1
White spruce	7	1	42	8	—	—	—	—
Norway spruce	—	—	68	1	—	—	—	—
European larch	—	—	45	4	—	—	30	1
Japanese larch	1	2	49	12	38	2	51	1
Average	5.9		61.3		35.8		69.0	
Hardwoods:								
Ailanthus	—	—	15	1	—	—	—	—
Green ash	8	2	86	12	30	1	90	1
White ash	1	2	81	12	47	1	49	1
Trembling aspen	—	—	0	1	—	—	—	—
Black cherry	—	—	86	1	—	—	—	—
Black locust	2	2	72	15	12	1	54	1
Red oak	34	1	62	9	77	1	78	1
Hybrid poplar	1	2	58	7	34	1	—	—
Black walnut	2	2	39	7	15	1	—	—
Average	5.9		61.3	7	35.8		69.0	
Shrubs:								
Arrowwood	0	1	61	4	—	—	—	—
Black chokeberry	42	1	76	4	—	—	—	—
American hazel	—	—	28	4	—	—	—	—
Silky dogwood	—	—	72	5	—	—	—	—
Multiflora rose	—	—	73	2	—	—	—	—
Average	21.0		63.7		—		—	
Type average	15.6		57.1		35.5		51.8	

TABLE 2.—ONE YEAR SURVIVAL OF FALL PLANTINGS MADE IN 1948 AND 1949 ON TYPE II AND III SPOIL

Good Survival (60-100 percent)	Adequate Survival (40-60 percent)	Unsatisfactory Survival (less than 40 percent)
CONIFERS		
European larch	Austrian pine	
Scotch pine	Red pine	Japanese red pine
Norway spruce	White spruce	Virginia pine
	Banks pine	White pine
	Table Mt. pine	
HARDWOODS		
White ash	Red oak	
Green ash	Chestnut oak	Black walnut
Black cherry		Sugar maple
Black locust		Tulip poplar
		Russian olive
SHRUBS		
Multiflora rose	Silverberry	Chicken grape
Common elder	Silky dogwood	American crab
		Tartarian honeysuckle
		Red elder

are averages of all plantings made over a 5-year period. They represent favorable and unfavorable planting seasons and a range of site conditions encountered under all types. Although the averages are low, they indicate the relative adaptability of the species tested for use on spoil banks. By carefully selecting the most promising species and placing them on sites to which they are best suited, successful large-scale test plantings have been made with a survival of over 60 percent. Such plantings during 1949 covered 27 bank areas and totaled approximately 200 acres, while in 1950, some 500 acres were planted.

Spoil Type I—These banks are composed of very strongly acid, thin-bedded, carbonaceous shale, gray in color, with pH 2.5 to 3.5. Unsatisfactory survival has been shown by all tree species tested except pitch pine, which just barely exceeded 40 percent (Table 1). The average survival of 15.6 percent given in Table 1 indicates the inability of this spoil type to support tree growth, at least until weathered for a number of years.

Spoil Type II—These banks consist of two subtypes: *A*, shale, yellow brown in color; pH 4.0 to 5.5, and *B*, non-pyritic, thin-bedded, blue shale, pH 3.8—6.1, occurring both pure and mixed with yellow-brown shale. These subtypes are classed together for purposes of planting.

A number of species have shown an average survival above 60 percent on this spoil, which is the most common type in the region (Fig. 4). In the past two years, heavy infestations of LeConte's sawfly caused high losses in 3- to 5-year-old plantings of Banks and pitch pine and accounts in great part for their survival falling below 60 percent; otherwise their survival was excellent. Promising species that have shown a survival of 40 percent or better over a 5-year period are listed below:

CONIFERS	HARDWOODS	SHRUBS
Banks pine	Green ash	Arrowwood
Pitch pine	White ash	Black chokeberry
Red pine	Black locust	Silky dogwood
Scotch pine	Red oak	Multiflora rose
Virginia pine	Hybrid poplar	
White pine	Black cherry	
Douglas fir		
Norway spruce		
White spruce		
European larch		
Japanese larch		

Spoil Type III.—Banks of this type contain acid sandstone predominant over shale; they are yellow, with pH 4.0. Survival on this type was uniformly low (Table 1), chiefly because of low soil content. However, where sufficient soil was present, several species have shown a survival of over 40 percent. These are: Banks pine, pitch pine, white pine, white ash, and red oak.

Spoil Type IV.—Glacial till comprises these banks. They are pale yellow-brown, with pH 4.5 to 8.0. Trees survive well on this type, if the slopes are graded to prevent erosion. Several trees have done

well; those surviving 40 percent or better are listed below:

Conifers	Hardwoods
Banks pine	Green ash
Pitch pine	White ash
Red pine	Red oak
Japanese larch	Black locust

Fall Planting Tests

Planting trees in the fall of the year on old fields in the section of Pennsylvania under study has been generally avoided because of danger of frost-heaving during the first winter. However, fall plantings of a number of species on spoil banks have been surprisingly successful. For example, Scotch pine, European larch, and white ash planted on eight banks in October 1948 showed a survival of over 80 percent through the first winter and early summer; trees planted in October of the following year showed a lower survival, but a number of hardy species were again successful (Table 2).

Although the winters of 1948-49 and 1949-50 had little snowfall to cover the soil, frost-heaving was not a serious factor on spoil areas, except for spots which had more than 40 percent fine soil of clay texture. On the common Type II spoil composed of shale with clay-loam soil content of between 20 and 40 percent, heaving did not occur; also, on sandy spoil derived from Type III spoil, heaving was a negligible factor in survival.

Successful fall planting has been carried out in large-scale tests by selecting from Table 2 the hardy species that resist winter injury; deciduous trees such as larch and hardwoods form the bulk of such plantings. Plantings of poorly developed seedlings have proved to be a waste of time, and many species that failed in planting tests apparently did so because of inferior stock. It is particularly important for all planting that the evergreens have small, compact tops and that all species have large, well-developed root systems with good lateral root development. For example, cherry and ash seedlings obtained with ideal "bushy" root systems did not heave on areas where black walnut with a short tap-root and practically no laterals heaved badly. The compactness of Scotch and Austrian pine and of spruce has made them good evergreen species for fall planting.

Fig. 4.—Test planting on Type II spoil immediately after planting in 1946, *above*, and in 1950, *below*, after 5 growing seasons.

Direct Seeding Tests

Direct seeding tests were made from 1947 to 1950 with red maple, box elder, American elm, red oak, chestnut oak, Japanese red pine, burr oak, chokecherry, and red ash on Type II spoil. The erratic and generally poor results obtained have indicated that planting of tree seedlings is more practical for general use than direct seeding. Rodent depredation and hot, dry weather in early summer appear to be the chief causes of failure. Planting is more likely to give satisfactory results over a number of years, which include good and poor planting seasons. Red oak acorns sown in late March provided one exception; they survived quite well on spoil banks. In 1948 and again in 1949 seeding with red oak in March was used successfully to fill in failures in plantations while fall and winter seedings failed.

Summary

An analysis has been made of the more important site factors which affect tree survival on spoil banks in Pennsylvania. Soil acidity and fine soil content of the spoil material, wind exposure, soil temperature, slope, and parent material must all be taken into account in planting plans. Natural development of vegetation has been a slow process on most spoil areas. An aspen-fire cherry community is the initial stage on unleveled banks. Natural stocking with trees has been inadequate on spoil banks less than 10 years old on 40 percent of the areas studied. Spring and fall planting tests plus a plantation survey have indicated that successful reforestation is possible in both seasons with a number of tree and shrub species. Leveling

and planting of stripped areas are prescribed in the current Pennsylvania law regulating strip mining. Much reclamation activity has resulted in the last two years as a direct consequence of that law, and forest tree planting forms a major part of the program.

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When Can Forest Recreation Be Considered as Exclusive or Dominant?[1]

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A discussion of the conditions under which recreation represents an exclusive or dominant use of forest lands need no longer be considered academic. Recreation as a full-fledged use can now be said to have attained mature stature along with the management of forest lands for timber, water, forage, and wildlife. On a national scale, this change has occurred most swiftly and pronouncedly during the past quarter century. It reflects the highly significant shifts which have come about in our culture with respect to such readily measurable factors as increased leisure time, greater mobility, larger spendable income, more people, longer life, and more activity among older persons. To these factors we may add a growing consciousness of the value of rural escape from the stresses of harried urban existence.

NOT SO MANY YEARS AGO many foresters looked upon recreation as something of an invasion into more or less "preempted territory." Where timber could be grown, timber production obviously was the "proper" and preferably the only objective that need or should be recognized.

The establishment of national and state parks in well-forested localities was accomplished only after considerable struggle and in the face of claims that valuable resources were being locked up. And the struggle continues to preserve those reservations which still possess valuable timber.

The growth and development of the current national, state, and local forest management systems, mainly for timber growing, has brought into even sharper focus the strength and insistence of the public demand for additional recreation space. Here at last could be found readily accessible natural facilities where the individual, unhampered by "no trespass" signs, could feel free to seek adventure, physical enjoyment, relaxation, or even contemplation in relative solitude.

In response to this unmistakable public demand, public lands are steadily being acquired or dedicated both for park purposes, and as recreational sites within areas established primarily for timber production. Maryland is a case in point. Joseph F. Kaylor, director of Forests and Parks, states that the present state park system provides 1 acre for each 400 of the state's population. This ratio is considered to be so inadequate that future acquisition and development plans envisage a ratio of 1 acre per 100 persons.

If we think of resources as goods or services having material value only, the recreational qualities of forest land cannot receive such distinction. But if we think of resources in terms of processes or facilities whereby man's productive capacities and mental-emotional maturity can be enhanced, the recreational qualities of forest land can definitely be classified as a resource. This concept has long been understood by cultural anthropologists and students of mental health. These investigators are fully aware of the therapeutic significance of play as a constructive social force of high group-survival value. Their studies have demonstrated that the degree of health and efficiency of effort of people in our culture, both as individuals and in groups, depends largely upon the opportunities for play, and especially the kinds of outlets for wholesome, socially acceptable forms of play.[2]

Forest land serves as an admirable outlet for such pursuits. The inherent values of forest land for re-creative activity may be considerably greater than has generally been realized. Most, if not all forests undoubtedly possess such values to some degree. It appears that wherever people have access to the forest — however small a given area may be, or for whatever purpose it may be held or managed —they find some kind of pleasurable activity there. This applies as much to those who own or work in the forest as to those who live nearby or pass through. The heavy informal use of well-forested private real estate within urban and suburban localities, as for example in and around Washington, D. C., is one illustration of this recognized tendency.

[1]Paper presented at a meeting of the Division of Forest Recreation, Society of American Foresters, Biloxi, Miss., December 14, 1951.

[2]Schumacher, Henry C. The importance of recreation to mental health. Second Annual Calif. Recreation Conference, San Jose, February 17, 1950.

National land policy, as it has crystalized so far, accepts and provides for recreation as a major forest use. Recreational activity in one or more forms has exclusive right-of-way in most forested tracts designated as parks. Recreation of one kind or another is encouraged or permitted, and commonly provided for in the management of national, state, county, and town forests, and forested wildlife refuge and management areas.

What principles can we now advance with respect to the conditions under which recreation may be considered as an exclusive or dominant forest use?

For purposes of discussion we might limit the scope of our inquiry to public lands where the problems of administering recreation, either as the sole use or as one among several, are most likely to receive systematic attention.

Recreation as Exclusive

There are situations where, as a matter of policy, areas possessing high commercial values have been dedicated exclusively — or almost exclusively—to recreation. Behind such policy we may observe at least three major considerations: *First*, close or near proximity of forest lands to dense populations, as exemplified by the state, county, and city forest park systems of America. The park systems of metropolitan and adjoining areas of Washington, D. C., Portland, Ore., Chicago, Denver, and Detroit represent specific illustrations of the provisions for urbanite recreation. Here recreation pressures are so great, that building site values and tax revenues must be foregone. (It is worth remembering that the building site values foregone by urban localities are many times greater than the timber values lost when forest areas considerably distant from dense population centers are set aside for parks.) *Second*, the occurrence of rock formations (in a forest setting), unusual stands of virgin timber, or other natural features which are so unique, whether by reason of individual characteristics or man-created scarcity, that their preservation value is accepted as superior to those values which could be derived by their commercial development. As examples of outstanding natural features we may cite Mt. Ranier National Park, and Mt. Katahdin State Park in Maine. Examples of unusual forest growth include the Olympic National Park, Joyce Kilmer Memorial Forest in North Carolina, and the Adirondack State Forest Preserve.

A *third* policy consideration relates to the occurrence of roadless and otherwise undeveloped areas of sufficient size, attractiveness, and primitive character to afford extensive recreational use where solitude and freedom from the influence of modern civilization can be achieved to a maximum degree. By administrative determination the use of national forest wilderness is limited entirely or largely to extensive recreation. Here the possibilities of conflict with non-recreational uses have been minimized by a systematic selection of areas where timber, mineral, or livestock grazing values appear to be relatively low.

It should be recognized that such preserves as park and wilderness areas are definitely not exclusive as to value. The same areas may have actual or potential values for watershed protection, timber, wildlife, grazing, mineral exploitation, residential, commercial or industrial development, etc. But by reason of one or another of the major considerations previously mentioned, our society, through due process of law and administrative procedure has decided that within such forest areas recreation shall be exclusive, or nearly so. Economic analyses, such as those represented by monetary cost-benefit comparisons, may or may not enter into the discussions and deliberations preceding such decisions. The fact remains that the nonmonetary or social welfare values are judged to exceed sufficiently the dollar values which might be gained by exploitation, however well controlled, to warrant complete dedication to recreational use. By the same token, should future needs for material resources become so desperate as to require utilization of exclusive recreation areas for national survival, social decisions can be changed accordingly. In the meantime, these other resources will still remain available to meet such contingencies. However, taking into account the current progress in forest conservation and technology, I for one do not believe that we need face this possibility in the foreseeable future.

Recreation as Dominant

The U. S. Forest Service reports that in 1950, recreational use of national forests reached an all-time high. Some 90 percent of the 27 million visits involved the simpler forms of enjoyment — hiking, horseback riding, hunting, fishing, etc. A large part of these activities occurred on portions of national forests managed primarily for utilitarian purposes.[3] Several millions more enjoy the state, county, and municipal holdings administered for timber growing, game management, or water supply protection. Recreational pressures are becoming so intense that even in such areas it has been necessary to recognize this activity and to provide for it accordingly. Special facilities are made available to handle picnicking, group camping, summer residence, fishing, and bathing demands. Strips of uncut timber are left along streams and roads; small spots are left intact to preserve some attractive glen or other natural feature; scenic viewpoints are made more accessible by trails. Beyond these facilities we find hikers, riders, canoeists making increasing use of fire trails, game trails, old logging roads, watercourses, and other handy means of visiting the recreationally unimproved portions of these forests.

Under such situations, recreation can well be considered as dominant or at least codominant with nonrecreational pursuits. Indeed, well-managed timber operations, fish and wildlife developments, watershed improvements themselves constitute recreational attractions. The provision of well-planned ac-

[3]News item: Forest recreation use at all-time high. Jour. Forestry 49: 479. 1951.

cess to representative operations can do much to advance the public's understanding and support of forest land management endeavors. Under these circumstances I see no reason why recreation and nonrecreational uses cannot thrive together on the same areas. Efforts already made along these lines on some national and state forests indicate promising possibilities for further progress. This approach should permit satisfying much of today's growing recreational pressure without necessitating a proportionate reduction in the areas devoted to timber growing.

Management to Minimize Conflicts

That conflicts will occur from time to time may be taken for granted. Such conflicts might be grouped into at least two broad categories: conflicts between recreation and nonrecreational activities, and conflicts among various forms of recreation. In general, advance planning and efficient management should go far towards resolving both kinds of conflict without adversely affecting the public interest.

Conflicts of the first category—where timber growing represents the primary use, for instance—can often be resolved by setting aside limited spots for picnicking and other intensive pursuits and by limiting recreation elsewhere to those extensive types of use which interfere least with timber management. Conversely, on multiple-use areas where recreation rates first, management can exercise its responsibility by so limiting the spread or intensity of other uses—livestock grazing, for instance—as to avoid damage to the primary function.

Conflicts of the second category—those involving recreation alone—probably involve even more delicate determinations. Managers of recreational resources often come under persistent pressure to favor the more intensive uses at the expense of the less intensive. Such pressures arise in part from commercial interests who care only for the profits — to them — from more people spending more dollars; other pressures come from organizations catering to those who prefer the comforts of the back porch and automobile and the gregarious environment of the city while sojourning in the forest; and still other pressures arise from concentrations of people attracted by choice natural features.

As a first principle, it is suggested that recreational management aim to achieve that balance among activities which most nearly will satisfy the objectives for which a given area was dedicated. This need is illustrated by conditions at the Cook Forest State Park in Pennsylvania. This park comprises some 6,000 acres, mostly in second growth timber. Old growth timber occupies 263 acres, of which only 61 acres supports a virgin white pine-hemlock stand. The major purpose of acquiring the land was to preserve this and adjacent virgin hemlock groves as "museum pieces." Excessive trampling by visitors—estimated by park officials to number as many as 64,000 people on one July 4 alone—to these unprotected groves, especially the pine-hemlock, has greatly shortened the remaining life of the aged trees.[4] Current removal of the dead and dying trees from their hard packed habitat amounts only to treating the symptoms of a sickness. A more adequate consideration of ecological requirements would have indicated the wisdom of fencing or other methods of damage prevention to assure the maximum possible life of the big trees, and perhaps to provide an opportunity for the next generation to enjoy them also. Advance announcements stating the necessity for preventive measures would have prepared the public for the subsequent restrictions.

This illustration, among others involving similar situations, emphasizes the desirability of forethought and advance planning to ensure that the recreational uses of given areas will harmonize most closely with the particular purposes they were intended to serve.

As a second and perhaps even more basic principle, the management of areas where recreation represents an exclusive or dominant use also carries with it a responsibility for the preservation of stable soil and waterflow conditions. Consideration of this principle indicates that climate, topography, soil properties, runoff, and other watershed characteristics should be taken into account in planning and constructing roads, trails, and other facilities, as well as in determining the kinds and distribution of recreational use adapted to the natural features. Application of this principle will become increasingly urgent as recreational loads become heavier and as additional areas and developments must be provided to meet them.

Summary

Cultural necessity is fast imposing recreation as a major objective of forest land management. On parks and similarly dedicated areas, social action has established recreation as exclusive. Here management faces the task of so guiding their use as to safeguard the purposes for which they were created. On nonexclusive areas, timber growing and other policies and practices will need to adjust to recreational pressures, but where foresight is applied, serious conflicts can be minimized. Harmonious relations may be achieved by zoning some localities against cutting or grazing, by modifying practices in other places, and by exploiting the educational, scientific, and aesthetic values of timber, wildlife, grazing, and watershed improvement operations generally. Finally, management for whatever purpose should actively promote the maintenance and improvement of desirable relations among cover, soil, and waterflow.

[4] Frank, Bernard. The Cook Forest can be saved. Living Wilderness, VII: 21-24. December 1942.

Notes

Planted Loblolly Pines Respond to Mulching

In April 1937 the Clarksville, Tenn. CCC Camp, under the supervision of the Soil Conservation Service, planted many acres of badly eroded land to pine trees. On a few of the areas planted, the worst eroded, galled spots were mulched with straw. One of these areas has been studied over the years, and the following information is based on observation made.

The area treated was Dickson silt loam with very severe sheet erosion, the a and b horizons gone, and frequent shallow gullies. The ground was bare with coarse, cherty material exposed. Alternate strips about 25 feet wide, more or less on the contour, were mulched with wheat straw to a depth of 2 to 4 inches. Old discarded woven wire was used on part of the mulched areas to hold the mulch in place.

Loblolly pine was planted on both the mulched and unmulched strips on April 7, 1937, spaced 6 by 6 feet. No replanting was done. The area has been protected from fire, and until recently, from grazing. A few cows have had access to the area during the past two years, but no grazing damage is evident. There has been no other treatment except protection since the area was planted.

The first observations were made on August 21, 1937. At that time, there was no appreciable difference between survival and growth of the pine on the mulched and unmulched strips. The trees on the mulched strips, however, had a dark green color, while those on the unmulched strips were light yellowish green.

The second observations were made on September 10, 1938 (Fig. 1). The trees on the mulched strips showed a much deeper green color and denser foliage. Many trees on the unmulched strips were barely surviving. Lespedeza and weeds were invading the mulched strips; the unmulched were still bare. The average height of the trees on the mulched areas was 2 feet, compared to 1¼ foot average on the unmulched areas. The maximum height of the mulched trees was 3-2/3 feet, while that of the unmulched trees was 3 feet.

Observations made on November 6, 1940 (Fig. 2) showed almost complete survival on the mulched strips with many blanks beginning to show in the unmulched strips. Average height on the former was 6 feet, compared to 3½ feet on the latter. A partial cover of pine straw was developing on the mulched strips, while the unmulched strips were mostly bare with just a few spots of partial cover.

FIG. 1.—Picture taken on August 8, 1938 showing strips of mulched and unmulched pine planted in the spring of 1937. Note the contrast in survival and growth on mulched and unmulched strips.

FIG. 2.—Follow-up picture taken on November 6, 1940, from same location as Figure 1.

FIG. 3.—Follow-up picture taken on August 29, 1951, from same location as Figures 1 and 2.

All averages were based on measurements of trees on typical, comparable areas, including 100 trees or more on the mulched and about the same number on the adjacent unmulched strips.

Observations were made again on August 29, 1951 on 1/32-acre plots in the immediate foreground of the photo taken on this date, Figure 3. Survival on the mulched plot was 100 percent compared to 53 percent on the unmulched plot. The average height was

FIG. 4.—Picture taken on August 29, 1951, showing contrast in ground cover on mulched and unmulched strips. The right side of the picture shows heavy litter of pine straw on the mulched area, compared to the very light litter and bare ground on the left side of the picture.

21 feet and average d.b.h. 4.0 inches on the mulched plot, compared to an average height of 11 feet and average d.b.h. of 2.5 inches on the unmulched plot. These figures were obtained by measuring all the 36 trees on the mulched plot and all the 19 trees on the unmulched plot. The mulched plot had a complete ground cover of pine straw, while the ground on the unmulched area was mostly bare (Fig. 4).

The results presented above very clearly show the benefits of mulching to bring about the early establishment of ground cover on eroded sites, better survival, and faster growth of planted trees. The better growth and survival can evidently be attributed to two factors, first, the mulch provided immediate ground cover, reducing soil erosion to negligible proportions and preventing further site deterioration and, second, the increased absorption of rainfall by the mulched soil provided better moisture conditions for tree growth.

On the basis of these and similar results, it would appear advisable to mulch at least the worst eroded, galled spots when planting similar eroded fields to pine. This would not only benefit the planted trees but also would encourage the natural invasion of other plants to provide ground cover.

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How Do Sulfamate Poisons Kill Trees?

In an effort to learn how poisons act on hardwood trees, a small test was run on southern red oak at the Crossett Experimental Forest in 1950. Cupric sulfamate, although a less effective tree poison than the closely related and widely used ammonium sulfamate (Ammate), was adopted in the hope that its staining characteristics would allow its movement in the tree to be traced easily.

The poison in crystal form was applied in cups (notches) at 6-inch intervals around the tree boles at the ground-line. One tablespoonful was placed in each notch in October 1950. Several trees, ranging 7 to 12 inches d.b.h. were treated.

Ten months after treatment the trees were cut and the boles and roots were cross-sectioned at frequent intervals for examination. Radial movement of the poison, as evidenced by a brownish discoloration, went to the heartwood and then stopped. There was no visible tangential movement of the chemical. Downward movement into the roots could be followed for at least 2 feet. In one tree, upward movement could be traced at least 32 feet. No stain appeared in the crown section of the boles, although the crowns showed damage and many leaves and branches had died.

It is still not known how this and other chemicals kill trees. Plant physiologists using radioactive tracer elements might be able to explain some of the questions raised by these inconclusive observations. Fundamental studies in this field could easily lead to cheaper and more effective methods of tree poisoning.

CHARLES X. GRANO,
Southern Forest Experiment Station, New Orleans, La.

Foresters Evaluate Experiment in Growing Asiatic Chestnut Trees on the Morgan-Monroe State Forest

On November 9, 1951, State Forester Ralph M. Wilcox, and other foresters of the Indiana Department of Conservation, and several other foresters (Fig. 1), inspected a $1\frac{1}{2}$-acre forest planting of Asiatic chestnuts on the Morgan-Monroe State Forest, near Martinsville, Ind. The plantation was established in the spring of 1938 by the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, and the Indiana Department of Conservation.

The plantation is one of 21 cooperative plantings established in 1926, 1938, and 1939 in eight eastern states on federal- and state-owned lands. Asiatic chestnuts and Asiatic chestnut hybrids are under test in the plots, to determine their blight resistance, rate of growth, climatic and soil suitability, usefulness as potential timber-producing trees, and productiveness in yielding nuts suitable for both man and wildlife. In each plot the planting site originally was covered with the better hardwoods. The areas were clearcut and then planted with about 25 kinds, representing four species and hybrids, of 2-year-old blight-resistant chestnuts. The 21 test plots aggregate nearly 32 acres and include 22,000 trees spaced 8 by 8 feet.

FIG. 1.—Indiana foresters, visiting the Morgan-Monroe State Forest near Martinsville, Indiana, to study chestnut plantation established in 1938.

One of the most striking facts observed by the Indiana foresters was that only Chinese chestnuts from certain seed sources and hybrid chestnuts show promise of becoming forest trees. Chinese chestnuts from other sources and practically all Japanese chestnuts, Henry (forest-tree) chinkapins, and "ever-blooming" Seguin chestnuts have died. Good growth of the chestnuts, as well as early establishment, is associated with certain soil characteristics (a soil map of the site was prepared by the Division of Soil Survey of the U. S. Department of Agriculture in 1942).

Fifty trees each of black locust, red oak, and white ash, all of comparable-aged planting stock, were included in the original planting. For the most part, the more promising kinds of Chinese chestnut have proved superior to the red oaks and white ash; but the black locust thus far has been superior to every other kind of tree planted on the site. Although superiority of certain kinds of chestnuts, with reference to establishment and rate of growth, are already apparent in 13 growing seasons, final evaluation cannot be made until they have withstood a longer test of time.

JESSE D. DILLER,
Pathologist,
Division of Forest Pathology,
U. S. Department of Agriculture.

A Problem Facing British Forestry

Technical obstacles confronting the forester in Britain, due to virtual lack of natural reproduction and the consequent necessity for heavy expenditures on planting and fencing against rabbits, are well known. But probably few American foresters realize that their British colleagues have to face also the bitter and often violent hostility of a large and influential part of the general public. An article in the highly regarded *Spectator*, evidently written to counteract this hostility, reveals the situation. Perhaps a note in the JOURNAL OF FORESTRY giving excerpts from this article might be useful by helping any of our members who may be discouraged to appreciate the many advantages enjoyed by foresters in America.

"The land surface of this island is limited—to about 56,000,000 acres. Foresters would like to have a tenth of it, a proportion much smaller than France or Germany devotes to forests. But whichever way they turn for the land they need (if they are to execute the programme provisionally approved by Parliament), they meet with objections. They are not allowed, as a general rule, to have good land suitable for intensive farming (and that is reasonable enough), but even when they go to poor sheep-walk country or almost barren moors, there are outeries. From the Brecklands of Norfolk and Suffolk to the mountains of West Wales, from Northumberland and the Lakes to the South Downs and the Quantocks, there is the same hostility. 'Not here. We have unique fauna and flora. . . . Not here, where families have been sheep-farming (one or two sheep per acre!) for ten generations. . . . Not here, where Wordsworth walked. . . . Not here, one of the most beautiful playgrounds of the people. . . . Not here, where we cherish the grandeur of a centuries-old wilderness.'

"Hostility to modern forestry in England is aggravated by the use of conifers. But, as has just been noted, it is conifer timber rather than hardwood timber which is particularly needed (in the 'thirties the proportion used was over 90 percent of one to less than 10 percent of the other), and the poor land which can be spared, however reluctantly, for forestry is conifer rather than hardwood land. This point deserves some elaboration and emphasis. The greater part of England, if not of Wales and Scotland, is less than 600 feet above sea-level and consists of fertile 'brown earth' soils. On such land the 'natural' trees are hardwoods, probably oak, and people feel that these are the right trees to grow, the proper English trees, anywhere in England. But the foresters are spared relatively little of such land; they have come late on the scene and must make do with exposed highlands and such near-deserts as the Brecklands or the territory of Rendlesham Forest near the Suffolk coast. And here conifers must be the main crop of any forest, at least on its first rotation.

"The opponents of modern forestry make the most of all minor disadvantages, and they have no scruples about the use of tendentious words and phrases. It is true that birds and flowers are likely to be fewer and less varied in modern forests, but then forests are not planted primarily for birds and flowers, any more than wheat or clover fields are planted primarily for their colour. 'Alien trees' and 'regimented plantations' . . . Of course many of the trees are as alien as greengages or scarlet runners, and they are as regimented as the avenues in the Mall. These words 'alien' and 'regimented' are nearly always used in a pejorative sense; one does not hear rhododendrons or Japanese cherries described as alien, nor are the drills of the springing corn described as regimented.

"'Drill' is, by the way, another favourite hate-word; others are 'dark,' 'dreary,' 'monotonous' and 'uninteresting.' The two former have the justification that the shade of dense plantations (and if young plantations are any good they are sure to be dense) is not particularly welcome in such a grey climate as ours, where the sun is loved. As for conifers being monotonous or uninteresting, these words apply to almost any subject of which a man knows almost nothing; and inability to tell one tree from another does not deter 'country-lovers' from expressing violent opinions. Essentially, conifers are neither more nor less varied and interesting than the very short list of broad-leaved timber trees indigenous to Britain.

"Foresters have made some mistakes in the last 30-odd years, and they will doubtless make some more in the next 30. But they have also made some very good forests. It will be a pity if their past achievement is denigrated and their future work obstructed by sentimental appeals to irrational prejudices. Well-informed criticism might sometimes do good, but hostile misrepresentation and opposition 'by every means in their power' (to quote a published manifesto of the Friends of the Quantocks) is at best unconstructive and may well create an atmosphere of poisonous bitterness. Even where goodwill and intelligence prevail, there are difficulties enough, especially about the finding of land for the forest programme."

BARRINGTON MOORE.

A New Kind of Experimental Watershed

Chestuee Creek watershed, 85,000 acres in Polk, McMinn, and Monroe counties, southeastern Tennessee, has been selected as the area for Tennessee Valley Authority's first attempt at intensive, integrated resource development on a small watershed basis. H. A. Smith, former manager of TVA properties at Guntersville, Ala. has been named to head up the project for TVA. The University of Tennessee will play a major role, as will other public agencies.

The objectives are to demonstrate maximum citizen and public agency cooperation in defining and solving agricultural, forestry, hydrologic, social, and economic problems within the watershed. What types of agriculture and forestry will yield optimum long-range income and water use? What effect will adjustments in land use have on water yield? The project will be a demonstration of how to deal with land use and water control problems. At the same time, it will include intensive research on the water-holding capacity of soils under different agricultural treatments. Progress can be measured in terms of water yield at the mouth of Chestuee Creek and at the outlets of several subwatersheds.

TVA has been working toward these same objectives throughout the 26-million-acre Tennessee Valley, but nowhere have resource development activities been sufficiently concentrated to permit an accurate measure of their effects on water movement. The Chestuee project will fill this need. Seven-year records of channel runoff, ground water levels, soil moisture, and rainfall are available for making comparisons.

Chestuee Creek is 36 miles long. Its main channel is crooked and so filled with sediment that it can no longer carry the water from even moderate storms; floods occur practically every year. Elevations within the watershed range from 700 to 1,400 feet. Englewood, the largest town, has a population of 1,537. Thirty-six percent of the area is forested; 61 percent is open farm land. Soil types in general are such that they can be improved considerably.

A recent detailed inventory of the forest land shows that practically all forests are on farms; average size of woodland is 35 acres. Yellow pine predominates. About half of the timber production is being used for fuel and fence posts; the other half is manufactured into rough lumber.

The forest development program for the watershed includes extension of organized fire protection to the 90 percent of the area that still lacks it. Woodland grazing is practiced widely; its harmful effects are very much in evidence. On one subwatershed some 50 percent of the forest land is pastured under fence. Sixty percent of the sawtimber volume is in trees less than 15 inches in diameter. An estimated 80 percent of the fuelwood comes from small trees, most of which should be reserved as growing stock.

About 5,500 acres of eroded open land are in need of reforestation; 4,800 acres of understocked woodland might well be reinforced with 200 to 600 trees per acre. Nineteen sawmills in the watershed provide a too ready market for stumpage; a pulp mill is proposed within trucking distance. But there is no market for low-quality hardwoods or pine thinnings below pulpwood size. There is little or no integration of harvesting and utilization; any given operator is usually interested in only one product. These are the forestry problems. They will be attacked through the educational process. At the same time agriculturists will be working on agricultural problems; hydraulic engineers will be measuring the effects of changed land-use practices on water yield.

All conservation programs will be intensified.

All the land in Chestuee watershed is in private ownership. Whatever is done must be done by the people who own the land. It is relatively simple to manipulate a watershed when the investigating agency owns it. But there are 900 farmers in Chestuee. Here will be a demonstration of the accumulative effects of land-use adjustments on water and people—a demonstration tempered by the hard realities of diversified private ownership.

J. O. ARTMAN,
Tennessee Valley Authority.

Local Longleaf Seed Years

Once every eight or ten years longleaf pine bears a heavy crop of seed over much of its range. Legend and feeling have gradually come to regard this long interval as a major obstacle to regeneration and management of the species.

Records say little, if anything, about local occurrence of seed years. Yet it is of much more significance for the forest land manager to know how often to expect bountiful seed crops in his own locality than to know the probable pattern over the wide range of the species. This paper reviews the evidence on longleaf cone production in southern Mississippi in an attempt to determine the frequency of local seed years.

Seed Crop Records

Prior to 1900, heavy seed crops in various localities of the longleaf pine region were recorded only for 1845, 1872, and 1892. The long intervals between recorded dates of heavy crops in the nineteenth century doubtless result from lack of systematic observations.

Between 1900 and 1940, one locality or another reported heavy crops for 1907, 1913, 1919, 1920, 1928, and 1935; medium crops for 1916, 1921, 1922, 1924, 1929, 1931, 1934, and 1939; and light crops for 1927, 1929, and 1931. Here again, the apparent paucity of seed years in the first decade is the result of inadequate recording. But in the thirty years from 1911 to 1940, there were fourteen medium or better crops over most of the range of longleaf pine.

How do these adjective ratings relate to actual cone production? Wahlenberg,[1] from whose book the foregoing records have been obtained, surmises that in heavy seed years about 90 percent of the longleaf seed trees bore cones, with about half of the trees bearing more than 50 cones each; in medium and light years, the proportion of cone-bearing trees and the average number of cones per tree both fell off.

These records are principally derived from virgin stands or from scattered, residual longleaf, remnants of the virgin stands. In the early 1930's, however, second-growth trees began to produce seed in quantity, and figured largely in the cone crop estimates which the Southern Forest Experiment Station and its cooperators made for 11 years beginning in 1931. For longleaf pine in southern Mississippi, these estimates were:

1931—medium
1932—very light
1933—light
1934—medium
1935—heavy
1936—medium
1937—very light
1938—light to medium
1939—medium
1940—very light to light
1941—failure

These estimates ended when World War II began. However, local observations, mainly on experimental tracts in Harrison and Pearl River Counties, have rated the succeeding years as follows: 1943—medium to heavy, 1945—light, 1946—medium, 1947—very heavy, 1948—medium, 1949—very light, 1950—light, 1951—light. No records are available for 1942 and 1944, but probably they had very light crops or none at all.

Thus, in the past 21 years, longleaf pine in southern Mississippi has borne two heavy or better cone crops, seven medium, and five light crops.

[1] Wahlenberg, W. G. Longleaf pine, page 71. Washington, D. C. 1946.

TABLE 1.—CONE PRODUCTION FROM EIGHT SECOND-GROWTH LONGLEAF PINES

Year	Adjective rating	Good site[1]	Poor site[2]	Average of both sites
		Average number of cones per tree		
1946	Medium	156	106	131
1947	Very heavy	284	225	254
1948	Medium	250	82	166
1949	Very light to failure	23	1	12
1950	Light	121	37	79
1951	Medium	235	59	147

[1] Fine sandy loam, fortuitously fertilized.
[2] Dry sandy soil.

Quantities Implied by Recent Ratings

These subjective ratings—heavy, medium, light—are more meaningful if related to quantities of cones or seeds per tree or per acre. Such information is now being obtained in connection with a comprehensive study of longleaf pine seed production undertaken by the Gulfcoast Branch of the Southern Forest Experiment Station. Preliminary data from an exploratory test on eight second-growth trees now about 12 inches d.b.h. are summarized in Table 1.

Assuming that further research substantiates them, what do these ratings and values signify to the man handling longleaf forest lands? They mean that in medium or better years he may expect the average unercowded longleaf of 12 inches d.b.h. or over to bear about 100 cones or more. Since each cone usually yields at least 50 sound seeds, each seed tree would produce about 5,000 sound seeds. On all but devastated longleaf lands it should be possible to find about 10 trees per acre bearing seed in this or greater quantity. Under these circumstances, seedfall would amount to about 50,000 seeds per acre. On well-managed land, and barring droughts, this should be enough to establish 2,500 to 5,000 yearling seedlings per acre.

It is not contended that Table 1 is representative of all southern Mississippi, for the mean yield of cones from the fertilized and the

poor-site trees might still exceed the average for the province. But the table does show the range and magnitude of mean yields which accord well with specific adjectival impressions.

This brings into question the widespread feeling that only heavy crops are sufficient to feed the wildlife and simultaneously provide for pine reproduction. It is true that most of today's pole-size second-growth longleaf stands in southern Mississippi date back to heavy seed years, particularly 1913, 1920, and 1928. But these stands, for the most part, became established despite heavy odds imposed by unmanaged, open range conditions. On the McNeill Experimental Forest, which was fenced against hogs and sheep, Wahlenberg recorded a catch of 15,000 to 19,000 one-year-old seedlings per acre from the 1924 crop, which he termed medium, and 5,000 to 9,000 one-year-old seedlings per acre from the 1927 crop, which he regarded as light.[2]

Seedling catches of this magnitude appear adequate for restocking purposes when timely protection and other good land management practices are applied. In the future, then, managers of longleaf will not depend on heavy seed crops alone. They will doubtless take advantage of medium crops and possibly also of light ones. In southern Mississippi there have been 9 medium or better crops, and 14 light or better crops, in the 21 years since 1930. This is, on the average, a light or better crop twice in every three years—a fairly encouraging pattern.

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[2]Wahlenberg, W. G., S. W. Greene, and H. R. Reed. Effects of fire and cattle grazing on longleaf pine lands as studied at McNeill, Mississippi. U. S. Dept. Agric. Tech. Bul. 683. 1939.

Need for Short Courses and Clinics

In the article, "The Society of American Foresters and Forestry Education," appearing in the January 1952 JOURNAL OF FORESTRY, Myron Krueger makes a significant statement: "In all forest regions of the United States there is abundant evidence of the enormous increase in demands for technical forestry skill on the part of forest owners." He cites the example of one large forest owner of the Pacific Northwest who is employing soils experts to classify the soils in his ownership. He then adds, "In my opinion we are now in another transition phase of forestry; therefore, it is up to every school faculty to reexamine its own offerings in the light of this change in professional demands."

With all this I heartily agree, but is this enough? What about the 18,000 or more graduates that have completed their formal academic training and that may need to review some of their basic technical work and to be brought up to date on the new techniques and professional emphases? On page 74 of the same issue of the JOURNAL appears a news note entitled, "Forest Soils Course, University of Washington." This note describes a 3-day short course in forest soils sponsored by the University of Washington and consisting of both classroom lectures and field studies. The course was attended by 30 foresters from industries and public agencies in Washington and Oregon.

Such short courses, it seems to me, strike close to the heart of the problem of postgraduate education of on-the-job foresters; namely, their education in the new professional developments. During recent years a number of forestry schools have conducted such seminars, with or without academic credit, especially in the field of business administration. It seems to me that the forestry school faculties with the cooperation of specialists in other agencies or institutions could well take the lead in sponsoring similar postgraduate courses in still other fields. Among these might be mentioned: (1) the application of aerial photographic techniques in forestry, (2) the application of log- and tree-grading practices for determining quality of timber products, (3) the development and evaluation of land-use, flood-control programs, (4) the place of recreation in forest land administration, (5) integrated logging techniques, (6) cost accounting for woodland owners, and (7) the application of statistical techniques to forestry problems.

How can the Society help to stimulate these postgraduate educational efforts? To a considerable degree the schools are already aware of the need for, and the possibilities of, this phase of professional education. The Division of Education could, if its officers wish, fan interest in it. In some instances sectional officers of the Society, working with forestry schools and other agencies in their territory, could stimulate action. A combination of the two approaches might be still more effective. A committee of the Division of Education might suggest over-all policies and procedures to be carried out locally by section committees appointed for this purpose.

Such a program would tend to keep the forestry profession in line with the medical profession, for example, where outstanding practioners have for many years held clinics for their contemporaries. Furthermore, it would put the forestry profession "in step" with the trend toward more and better adult education.

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Reviews

Charcoal Production and Uses.

Bulletin 37, Northeastern Wood Utilization Council, Inc., New Haven 6, Conn. 101 pp. Illus. 1952. $2.00.

Present production of charcoal in the United States is less than the total demand for industrial and public use. Defense production has increased the need for charcoal for industrial purposes and the greatly expanded use of outdoor grills has increased the demand for charcoal for home and picnic use. In the past, much of the charcoal production occurred as a by-product of wood distillation, but today, charcoal is the main product and the gases and distillates are not generally recovered. Since species, sizes, and defects are not as important in charcoal production as in other wood uses, it offers a means of outlet for material from thinnings, improvement cuttings and the tops left after the regular logging operations. However, the labor costs of getting the material from the woods to the charcoal production plant is a seriously limiting factor, and it is responsible for raising the cost of charcoal to undesirable levels.

There is a great deal of interest in the possibilities of charcoal production as a conservation measure, a means of additional revenue for the managed forest, and as a means of supplying the increasing industrial needs. Because of this interest, the Northeastern Wood Utilization Council held a charcoal conference on September 14, 1951 at the University of New Hampshire. It was well attended by men from both private industry and public agencies. This bulletin, *Charcoal Production and Uses*, is a presentation of the proceedings of the conference, including papers presented and the discussions which followed. The bulletin contains ten papers as follows: The Physical and Chemical Properties of Commercial Charcoals in Relation to Industrial Uses; Small Rectangular Charcoal Kilns; Charcoal Production in Steel Drums; The Continuous Carbonization of Wood—Sific Process; History and Present Status of the Industry; Continuous Carbonization, the Mellman Retort; Beehive Kiln Operation; Domestic Uses and Distribution; Industrial Uses; Briquetting of Charcoal; and Active Carbon.

The first paper describes the properties of charcoal such as ash content, fixed carbon and volatile matter, moisture relations, sulphur content, density, and smokiness, and the relations of these properties to major uses such as carbon disulphide manufacture, domestic fuel, making of pig iron and black powder, for tobacco curing, as an additive in stock feed, and as activated carbon. The next five papers deal with the construction and use of various types of charcoal kilns from the relatively inexpensive small-capacity rectangular and drum-type kilns which are portable, to the large-capacity, very costly, stationary continuous operation retorts. Design, operation, cost, and quality of product are discussed. It appears evident that, in the average operation, the most economical and efficient installation is that of from one to a battery of small-capacity kilns, rather than one large-capacity kiln or retort requiring a large capital investment.

The problems of distribution of charcoal for domestic use, and those of industrial uses are discussed. One of the problems of charcoal making is the disposal of the fine material which accumulates with every charge. Although the demand for lump charcoal exceeds production, the opportunities for marketing the fines are relatively limited. One of the methods of marketing fines is through the formation of briquettes which are then sold as fuel. Briquetting methods and equipment are discussed.

The last paper deals with active or activated carbon, which is valued in industry for its absorptive and catalytic properties. In 1950, over 76 million pounds of active carbon were produced, capable of decolorizing, deodorizing, and of water purification, in addition to that produced for gas masks and solvent recovery. Properties, production, and use of active carbon are discussed.

The importance of charcoal production to the forest owner should be recognized. The production of charcoal is one of the many methods by which silviculture and utilization come together on the forest property—it offers both an opportunity and a challenge to forest property management.

J. Hugo Kraemer,
Washington, D. C.

Illustrated Guide to Trees and Shrubs.

By Arthur Harmount Graves. 240 pp. Illus. Published by the Author, Wallingford, Conn. 1952. $4.

To anyone with an awakening interest in trees and forests, attention is first directed to identification of the species. Such a person now has a wide and often bewildering choice of books to assist him, ranging from highly technical to the 25 cent pocket manual variety. Sargent's *Silva* has been reprinted; there are handsomely illustrated books; and almost every state and experiment station publishes a manual, distributed free or at a nominal price. This is all excellent forestry propaganda, although not intended as such. Interest people in trees and they will become interested in forests and their conservation. Also the more books there are, apparently the more the demand. So we welcome the appearance of a new tree manual, the more so since it is a rather unique sort of tree book.

Every tree book presumably has some one or more good points that others lack, or one book suits one individual taste better than an-

other. If you are looking for an exhaustive taxonomic treatment, a fully documented treatise, or a pretty picture book with colored views and landscapes you will find none of these in Dr. Graves' book. This is a guide to common exotic as well as native species from Pennsylvania to Maine. The author has rather produced a practical guide in relatively simple language that can be used to identify a tree or shrub. Moreover, you will find all the commonly planted exotic trees and shrubs, and not have to search through three different books. The line drawings are large and clear, and show more distinctly than half-tone photographs the characters useful in identification. These are mostly of leaves, buds, and twigs. There are two half-tone reproductions of photographs, both of cones; but the large clear drawings by Maud H. Purdy are distinctive features of the book.

Perhaps it is odd to start with mention of illustrations, but that is what first strikes the browser after tree books. The producer of a book can either hang the illustrations on the framework of a synoptic key like ornaments on a Christmas tree, or construct a description around some well-chosen photographs like Collingwood's *Knowing Your Trees*. It looks as if the former pattern was dominant since Dr. Graves purpose is plainly to enable the reader to find out how to identify a tree or shrub definitely on sound botanical characters, and yet with a minimum knowledge of botanical terms. In this he has succeeded admirably.

After glancing at the illustrations let us examine the text. Here unlike some books, it is important to read the preface and introduction, for here will be found the key to abbreviations, (e. g., "brt." = branchlet) without which advance warning the reader would be puzzled as the uninitiated wanderer among alphabetical agencies in Washington. There are not many abbreviations. Were they introduced to teach the reader a kind of shorthand to use in his own notebook? Otherwise one may question their usefulness. It is unlikely they save many lines of text.

Nomenclature follows Gray's *Manual* eighth edition "for the most part" but Rehder's *Manual* and *Standardized Plant Names*, 2nd ed. have also been used as authorities, due naturally to the inclusion of exotics. Unfortunately this results in some unfamiliar names. As to how a shrub may be distinguished from a tree Graves is inclined to a minimum of 15 feet in height to be classed as a tree, but rightly points out that the habit of a plant is of as much importance as the ultimate height. The arrangement is the familiar one of Engler and Prantl. A general key of 17 pages follows the introduction, but "In case time is short and the flesh is weak" the reader is referred to a short-cut key and tips at the back of the book. The general key, however, is excellent and emphasizes leaves, buds, and twig characters. There are also special keys under each of the larger genera. In the case of oaks both a summer key and a winter key are provided.

There is no separation of trees and shrubs, all being arranged under families; in some cases only does the description state whether the species is a tree or shrub. The descriptions are brief but clear and exact. The preferred common name is given first, but rarely is more than one listed as befits the brevity of the book. Common names have a real attraction when they have a local aroma. They were a highly entertaining feature of Sudworth's early check lists. Why abandon them? Local common names often give shrewd clues to identification (e.g. "cat spruce"). Not only the backwoods appellations but the French-Canadian names are full of folklore and botanical confusion! When shall we have a book on common names and their origins?

Dr. Graves has produced a most useful field manual even if it is too broad for most pockets. It is based on over forty years' experience in teaching dendrology not only to students (foresters remember him as one of the early instructors at the Yale Forestry School) but to large groups of the general public. Without over-simplification he has now produced a book that foresters working in the Northeast will find most helpful.

HENRY I. BALDWIN.

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Empire in Pine, the Story of Lumbering in Wisconsin, 1830—1900.

By Robert F. Fries. 285 pp. Illus. State Historical Society of Wisconsin, Madison. 1951. $4.

Primarily an economic history of the exploitation of a great resource, this book recounts the development of an industry from the days of small water power mills to the time when one company was sawing 750,000 board feet a day. Logging changed from the sleigh haul and river drive to power loaders and logging railroads, while transportation of sawed lumber began with river rafts floated down to cities on the Mississippi river or by sailing schooners to ports on the Great Lakes. Capital and skilled operators, first sought in New England, at the end of the period were moving to the south and west.

The author drew much of his source material, including original manuscripts, from the State Historical Library. The subject of logging was not so well covered in written records as those of economics, management and sociology, nor was the author so well qualified. As a result the chapter "Gathering the Raw Material" is not up to the standard characterizing the work as a whole.

To a forester familiar with the old logging methods some of the explanations are quaint. It is explained that it was the practice to notch a tree with axes on the side toward which it was "expected" to fall. As to the common skidding tongs, "Many camps adopted an instrument resembling a pair of ice-tongs that could be clamped onto the end of the log." Also, "The measurement of logs never became an exact science. Instead of computing the actual number of cubic feet in the log the scaler, using one of several formulas, esti-

mated the number of board feet it ought to produce."

However, the book is excellent reading for foresters and the old photographs are well chosen to illustrate the activities in the woods and on the river. The author is at his best when he lays the setting of the scene and covers the problems of management, transportation, and labor. There are small human interest items such as the daily consumption of two barrels of salt pork in the company boarding house in one sawmill town.

Most fascinating is the account of the cutting of log booms on the Chippewa River, the strategic importance of Beef Slough, and the battles in the legislature, the Congress, and state and federal courts as to log rafting on the Mississippi. The issue was whether the logs would be sawed locally or down the river as far as Davenport, Iowa, or Rock Island, Illinois. It was from the latter city that the young immigrant, Frederick Weyerhaeuser, entered the scene. Here it is appropriate to add to the story that only he, of all the timber barons, ever gave to the state a tract of cut-over lands to be devoted to forestry.

For the quoted verses from old river ballads, this reviewer would have substituted some from "The Banks of the Little Eau Pleine," where a disconsolate schoolmarm mourned for a jolly young raftsman and learned that her Johnny was drowned in the Dells:

We buried him 'neath a scrub Norway
You will never behold him again
For way down the river your lover
Sleeps so far from the Little Eau Pleine.

Since her day, wealth derived from the forests has built the power dams making this the hardest working river in the nation and orders from the office of the Wisconsin Valley Improvement Company at Wausau regulate the headwaters storage reservoirs to govern its flow, pointing to poetic vision in the schoolmarm's imprecation:

My curses attend you, Wisconsin
May your rapids and falls cease to roar.

F. G. Wilson,
Wisconsin Conservation Department.

Range Management: Principles and Practices.

By A. W. Sampson. 570 pp. Illus. John Wiley & Sons, Inc. New York 16, N. Y. 1952. $7.50.

Foresters who are in any way concerned with grazing problems will be interested in this up-to-date summary of the many facets of range management. The inter-relationships between climate, soils, plants, animals, economics, and range management have been treated. The author pictures these relationships in the form of a wheel, with range management as the hub and the related subjects encircling it as the rim. His aim is to show how to keep this "wheel of range management" in balance by properly applying scientific principles evolved from these related subjets in the management of range lands and its grazing animals. The 24 chapters are presented in four parts: I. Range Management in Perspective; II. Native Range Forage Plants; III. Improvement and Management of Range and Stock; IV. Protection of Land Resources and Range Livestock.

It is noteworthy that the book considers range management in both the western and eastern halves of the United States. The coverage is such that the book is ideally suited as a text for general courses in range management, or as a reference for advanced courses. It may disappoint those who seek an advanced text for courses in range-ecology, range utilization or the like—but it must be remembered that the author's aim was to present a balance in subject matter—an aim that he has admirably accomplished.

Anyone concerned with multiple land-use management will find Part IV of special interest. It contains an excellent résumé of the compatability of grazing and timber production, discussed from the standpoint of individual forest regions. Another chapter treats the problems of big game, predators, and rodents in their relationship to the grazing industry. In a chapter treating soil erosion, the causes of erosion are discussed under the headings of geologic, climatic, and biotic influences; erosion control measures are given a brief but realistic treatment. The reference value of the book is enhanced by the chapter on poisonous plants. It is well illustrated with both line drawings and two color plates. The final chapter which concerns administration of public lands will be welcomed for its charts, maps, and tables that compare agency organization and functions.

The technician will be particularly interested in Part III. These nine chapters concern the actual work of the range manager. Range reseeding procedures are discussed from a regional standpoint. A short chapter on grazing systems summarizes the present knowledge on the subject—a subject which appears to need further research. The author's own research on chaparral burning has served him well in the preparation of an interesting chapter on the use of fires and chemicals to control noxious woody range plants. Likewise Dr. Sampson's earlier classical work on plant succession as related to range management has been projected into the present technics of determining range condition and trend. To round out the discussion of skills necessary to the range technician, each of the various approaches to range condition and utilization has been presented.

A feature not found in earlier range texts is a chapter concerning the world's grazing practices and problems. With accompanying maps, there is discussed on a regional basis the grazing industry of each continent, with a summary on likely trends of future development. In this discussion there is indicated the contribution in livestock breeds or range plants which the various countries have made to the grazing industry of the United States. The remaining chapters of Part I present in a concise fashion

information on plant physiology, ecology, soils, and climate as related to range problems.

Part II on native range forage plants is well illustrated with line drawings and contains terse descriptions and indications of the grazing value of 85 grasses, four grass-like species, and one or more species of 45 genera of forbs and browse plants. There is a key to the more common grass tribes and genera. As suggested by the author in his preface, the technical worker will find need for more complete local or regional works to meet all his needs; even so, this part of the book will serve as a handy reference for information on many important range plants.

Two additional features worthy of note are the literature citations at the end of each chapter—a total of some 859 citations—and a combination author-subject-plant name index.

This book is another major contribution of Dr. Sampson's to range literature. It seems only fitting that this text which bids to exert considerable influence on range management in the future should be written by one of the pioneering leaders responsible for the development of scientific range management. His experience in range research with the U. S. Forest Service during the period 1907 to 1923, and in both teaching and research at the University of California since 1924 has been used to advantage in the preparation of his latest book. Students, teachers, and workers in the field will surely welcome this scholarly up-to-date treatise on range management.

DONALD F. HERVEY,
Colorado A & M College, Fort Collins.

Water and Man: A Study in Ecology.

By Jonathan Forman and Ollie E. Fink. 407 pp. Illus. Friends of the Land, Columbus, Ohio. 1950.

This work is a faithful record of the major papers presented at the Eighth Annual Conference on Conservation, Nutrition and Health, which convened on the Ohio University campus, at Athens, under the sponsorship of Friends of the Land. The technical bricks were provided by some thirty experienced guest lecturers, with the mortar and architecture of Forman and Fink shaping up the conference structure. The symposium unfolds about a unified theme, with the various papers throwing light upon special facets of the main problem. Here the unifying theme is the vital role of water in the evolution and continuous support of civilization. For complete documentation of the indispensibility of water to life, this book offers convincing t e s t i m o n y; testimony drawn in the main from seasoned experts that know whereof they speak. Surely men such as J. V. B. Wells, C. W. Thornthwaite, H. L. Shantz, E. N. Munns, and B. W. Allred need no introduction to forest scientists and administrators.

The facets explored cannot be fully catalogued here, but include such diverse topics as stream pollution, water in body metabolism, irrigation agriculture, splash erosion, and meteorology in the service of water conservation. If you have not yet strolled over Mr. Bromfield's Malabar farm, or if you have thus far missed out on H. E. Schwan's biography of a watershed on the Manitou Experimental Forest, this book will round out the breadth of your experience to that extent.

There is an intriguingly subsection titled "Other Methods of Developing a Watershed Than by Valley Authorities," which will evoke a varied response on the part of students and practitioners in the field of natural resource administration. Here is unfolded the story of Brandywine Valley, the Muskingum Conservancy District, the lessons learned on Coweeta, and a thumbnail sketch of what the Monongahela Power and Light Company is doing on the Monongahela River. In this sub-section the president of the Mississippi Valley Improvement Association also takes the reader on an administrative excursion of the Mississippi (Missouri) River's Pick-Sloan Plan, taking time out as he goes to level a broadside at his favorite governmental demon, the TVA. Mr. Macleay's salvo will hardly go down in history as a lasting contribution to the theory of regional resource development, but it illustrates better than any scholarly work how the various interest groups find outlets for their respective points of view. Which is, of course, one of the major reasons for the existence of citizen conservation organizations, such as Friends of the Land.

In a democracy beset with increasingly complex and important issues of water resource policy, we need to recognize that all is not science, that much is sounding board. Certainly this forum, provided by Friends of the Land, has given much needed expression to both the science and politics of sound water use. Can ecology, which has to do with wholes, afford to approach the subject on narrower grounds? Probably not. *Water and Man* is to be commended for its courageous scope. To read it is to see the forest in deeper perspective.

H. E. BALL,
Falls Church, Va.

I Married a Logger.

By Julie Anderson. 328 pp. Illus. Exposition Press Inc., New York 16, N. Y. 1951. $3.50.

This book is written by the wife of a logger in Wakefield in the Upper Peninsula of Michigan. It is a chatty but authentic documentation of the logging industry of the Northwoods with its colorful, hard-working, lumberjacks of many nationalities. The present mechanical era of logging is skillfully blended with the epoch of oxen and river-driving by her recording of the reminiscences of a few old timers. Mrs. Anderson displays a good reporter's talent for remembering human interest and putting down in a warm and lively fashion the conversations of the lumberjacks.

Here is portrayed the atmosphere and raw energy of the life

of the logging camp — the low rambling structures of cook-shanty, bunkhouse, blacksmith's shop and barns, with the rugged men and their paraphernalia of saws, horses, trucks, and tractors. The author catches well and accurately the vernacular of the loggers and lumberjacks, and the very special rendition of the King's English by the Finn, Swede, and other immigrant lumberjacks. She has an artist's eye for form, color, and texture and gives vivid descriptions of the moods and appearances of the forest at the different seasons of the year. The writer finds poetry in the simple things of nature.

The hazards of the logging industry—both economic and from the elements, including the ups and downs of the market, bad weather, deep snows, tough road construction, labor problems, accidents, and forest fires—are recorded accurately. Less serious but still formidable, sometimes amusingly so, are hazards encountered by the author while she lived as the lone female in a logging camp. Not the least of these are the ferocious mosquitos of condor-like wing spread, the bears (even more frightened than the lady!), mice, manure piles, pine snakes, tipsy "jacks," brambles, and a dearth of fancy chrome-plated plumbing.

The reader gets a liberal education in the importance of the Upper Peninsula's forest products in the economy of the nation, including such diverse products as pulpwood, veneer logs, and hemlock bark for tannin. The author points out how ultimate markets are not only national but international. For example yellow birch veneer logs ended up as British mosquito bombers, and bird's-eye maple in Northern French ports sold to cabinet makers and craftsmen.

One gets many chuckles out of the telling of amusing incidents in the everyday life of the "jacks" and of the extra-curricular activities of "booze, broads, brawls" as the author puts it, and to which this reviewer might add the "hurly-burly of Hurley," which has a very special connotation in our part of the Northwoods. There are flashes of humor and some adaptations of the fabulous Paul Bunyan yarns to local situations—all of which provides entertaining reading.

As a complementary touch to the book, the author adds a number of pen and ink sketches. These drawings which depict the saga of the lumberjack at work and at play are a far cry from the fashion sketches which she aspired to do as an art student at the Chicago Academy of Fine Arts. Paris was her youthful goal, but Wakefield, Mich. proved to be her destiny. With a strong sense of adventure and imagination she adapted herself to living in the "brush," and had and took the opportunity to compile a unique documentation of loggers' life in the Northwoods. The author may have been trained as an artist, but as one of her Swede "lumberyacks" might have said, "She is now a yournalist of da furst vater."

Hazel Stoick Stoeckeler,
Rhinelander, Wis.

The Pines of Mexico and British Honduras.

By E. E. M. Loock. 244 pp. Illus. Bull. 35. Union of South Africa Department of Forestry, Pretoria. 1951. Price, 17 shillings 6 pence ($2.47).

Mexico, with its extreme climatic and topographic variations from tropical lowlands to snow-capped volcanoes, probably has more kinds of pines (Pinus) than any other equal area within the broad range of this north temperate genus. Two detailed taxonomic studies of the pines of Mexico have been made, the first in 1909 by George Russell Shaw, an American architect and amateur botanist. Prof. Mazimino Martínez, a resident botanist, recognized 39 species with 9 additional varieties and 8 forms in his book on the Mexican pines published in Spanish in 1945 (Ed. 2, 1948).

Now, for the first time, is a report on the pines of Mexico from a forester's viewpoint in English. E. E. M. Loock, senior research officer, Department of Forestry, Union of South Africa, spent almost a year in Mexico in 1947, visiting most of the important pine areas except Baja California and Chiapas, and also went to British Honduras. His main objects were to clarify the botanical identification of Mexican pines grown in South Africa and to arrange for a reliable supply of the most successful species, mainly *P. pseudostrobus*. South Africa, which has no native pines, has turned to Mexico as a seed source because of similar climates and has successfully grown Mexican pines in plantations for more than forty years. Unable to arrange for seed collection, Loock had to remain longer in Mexico and collect and extract the seed desired.

One chapter is devoted to a description of the pine forests of Mexico and British Honduras by physiographic divisions, illustrated with photographs and accompanied by a map of the pine forests. Of special interest to foresters is the chapter on forestry practice in Mexico and British Honduras.

About two-thirds of the book is devoted to the chapter on systematics of Mexican and British Honduras pines. Loock accepts for Mexico, excluding Baja California (with 11 additional species and 2 varieties), 27 species of Pinus with 18 additional varieties (1 proposed by him as new in 1948) and 9 forms (1 new) and for British Honduras 1 additional new speices, *P. hondurensis*. Though he disclaims credit for the classification adopted, the treatment follows Martínez closely.

The key to all these named variations should be useful. For most species and varieties there are a detailed botanical description, distribution including climatic and soil requirements, planting notes or recommendations for South Africa, and a page of photographs of a tree, botanical specimens, and leaf cross section. These numerous photographs will assist identification, but botanical details of cones and seeds would have been clearer if reproduced on a larger scale utilizing blank space on the same page.

Loock has showed clearly that the pines called *P. caribaea* Morelet in southeastern United States and Central America are different species. He has proposed the new species *P. hondurensis* for the segregates in British Honduras and Guatemala and probably also Cuba. However, as *P. caribaea* was originally described from Isle of Pines, Cuba, *P. hondurensis* apparently is a synonym, and the slash pine of southeastern United States instead needs a change in name.

This reviewer ventures to predict that future conservative taxonomists will distinguish a smaller number of species of Pinus in Mexico. Further cultivation in South Africa should test the validity of some named variations. In the future where tree seeds are collected to establish commercial forests in another part of the world, it is hoped that special attention can be given to collection of some seeds from superior parent trees.

ELBERT L. LITTLE, JR.,
U. S. Forest Service.

The American Poplar, Its Importance For Europe.

OEEC Documentation. 53 pp. Illus. Technical Assistance Mission No. 13. Organization for European Economic Cooperation. Paris. 1951.

Les Peupliers Et Les Principales Essences Forestieres De L'est Des Etats-Unis, Rapport De Mission, Mai-Juin 1950.

By R. Rol. Report. Psp. 527-637. Illus. Ecole Nationale Des Eaux et Forêts. Nancy. 1951.

The species *Populus* has long been important in Europe, where early recognition was given its rapid growth, and timber producing value. Our own *Populus deltoides* was taken there as early as 1700 for crossing with the native black poplars. And through new hybrids, current economic needs are being met on an increasing scale. Indicative of the importance of poplar to Europe today are the congresses of the International Poplar Commission, to which most of the western European countries belong.

The authors of these two publications were members of a six-man mission to the United States in 1950. The men were poplar experts, representing the countries of The Netherlands, Belgium, France, Austria, Norway, and Sweden. Their study tour was arranged through the Marshall Plan. In this country, they travelled under a technical assistance project of the Economic Cooperation Administration, with the U.S. Forest Service participating in the planning and conduct of the tour.

These arrangements involved numerous contacts with research centers, production and utilization industries, and individuals conducting poplar studies through the range of the poplars east of the Mississippi River. It was the good fortune of this writer to accompany the mission as a "non-expert" trip manager.

The mission was instructed to study (1) the indigenous types of *Populus deltoides*, (2) the natural stands of aspens and balsam poplars, (3) the fast growing hybrids developed in the United States, (4) hybrids best adapted to European conditions, and (5) the production methods and utilization of poplar in the United States.

The reports bear notice. The first is the joint report of the mission members, while the second is the report made for his administration by René Rol, assistant director, National Forestry School, Nancy, France. The joint report is in English, while Mr. Rol's report is in French, with an English summary.

The joint report is in seven chapters. The first chapter is a description of *Populus deltoides* in its natural area and its culture in the United States. The second chapter similarly describes the American aspens. Next follows the important artificial hybrids, and breeding techniques, and a chapter on poplar diseases. Logging and utilization are discussed next, and the report is concluded with a chapter on conclusions and recommendations.

The report of René Rol is presented in much the same manner as the joint report for the American poplar, but differs otherwise to include observations on the eastern forests of the United States. Of apparent great importance during the study tour were the observations on the physical and biological factors necessary to proper comparisons with home conditions. These factors are developed at length by Mr. Rol. Illustrations in both this and the joint report are the product of excellent photography.

From the American viewpoint, technical evaluation of these works must possibly await such men as Dr. Ernest Schreiner, who is now in Europe studying poplar. But this much seems certain, missions such as this are highly profitable to the American profession when their product is a skillful report assembling most American knowledge in one cover, and analyzed from the position of the expert European practitioner.

HUME C. FRAYER,
Elkins, W. Va.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, The New York State College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

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Range Management

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Wood Technology and Utilization

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Effects of Chemical Treatment of Pulpwood Trees. By D. C. McIntosh. 30 pp. Illus. Canada Dept. of Resources and Devel., Forestry Branch, Bul. No. 100. 1951.

Society Affairs

Officers and Members of the Council, 1952-1953

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Simpson Logging Company
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Washington 6, D. C.

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International Paper Company
Mobile 9, Ala.

PERRY A. THOMPSON
12 Elkin Court
San Rafael, Calif.

RUTHFORD H. WESTVELD
Department of Forestry
University of Missouri
Columbia, Mo.

Canadian Institute of Forestry to be Host to Society of American Foresters in their First Joint Meeting

The joint meeting of the Society of American Foresters and the Canadian Institute of Forestry will be held in Montreal, Province of Quebec, during November 17-20, 1952. The headquarters hotel will be the Mount Royal.

This will be the first time that these two organizations will have met together. The Canadian Institute of Forestry was formerly the Canadian Society of Forest Engineers. It was organized in 1908.

W. A. E. Pepler has been appointed general chairman of the meeting. He is an officer of the Canadian Pulp and Paper Association, 2280 Sun Life Building, Montreal 2, P. Q. Assisting Mr. Pepler as vice chairman, representing the S.A.F., is Henry Clepper, executive secretary.

Program Committee

The Program Committee, which is arranging the programs for the general sessions and the joint dinner of the two societies, is J. L. Van Camp, Canadian Forestry Association, 4795 St. Catherine Street West, Montreal 6, P. Q., Canada. Assisting as vice chairman, and S.A.F. representative on the Program Committee, is Hardy L. Shirley, College of Forestry, State University of New York, Syracuse 10, N. Y.

General Sessions

The theme of this historical meeting is "Trends in North American Forestry."

W. A. E. PEPLER . . .
General Chairman

The first general session will be opened on the morning of November 18 with an address of welcome by K. G. Fensom, president of the C.I.F., and a response by George L. Drake, president of the S.A.F.

The second (final) general session will be held on the afternoon of November 20. A feature of this session will be a summation of significant discussion in relation to the control theme.

Business Sessions

Executive meetings of the S.A.F. Council will be held on the morning and afternoon of November 17.

The C.I.F. Board of Directors will also hold a business meeting on November 17.

These meetings will be followed by a joint dinner of the S.A.F. Council and the C.I.F. Board of Directors during that evening.

The regular Society Affairs session of the S.A.F. will be held on the afternoon of November 18, and the annual business meeting of the C.I.F. will be held at the same time.

Technical Sessions

The C.I.F. does not have subject Divisions in its organization, as does the S.A.F. Instead, by mutual agreement of the officers of the two organizations, seven technical sessions will be scheduled. These seven technical sessions will cover the same general fields as the S.A.F.'s eleven subject Divisions. There will be no Division meetings at Montreal.

For each technical session a two-man committee has been appointed, one representing the S.A.F., the other the C.I.F. These committees will provide the programs for their sessions. Because of time limitations, it has been necessary to schedule some technical sessions for a half-day only.

Forestry Education

Technical sessions on forestry education will be held on the morning and afternoon of November 17.

The program chairman is Robert P. Holdsworth, Department of Forestry,

J. L. VAN CAMP . . .
Program Chairman

University of Massachusetts, Amherst, Mass.

The co-chairman is J. W. B. Sisam, Faculty of Forestry, University of Toronto, Toronto, Ont., Canada.

Forest Management

Technical sessions on forest management will be held on the morning and afternoon of November 19.

The program chairman is Gordon Godwin, Ontario Paper Company, Thorold, Ont., Canada.

The co-chairman is E. B. Moore, Department of Conservation and Development, State House Annex, Trenton, N. J.

Silviculture

Technical sessions on silviculture will be held on the morning and afternoon of November 19.

The program chairman is Harold J. Lutz, School of Forestry, Yale University, 205 Prospect Street, New Haven 11, Conn.

The co-chairman is George S. Allen, Faculty of Forestry, University of British Columbia, Vancouver, B. C., Canada.

Forest Economics and Taxation

A technical session on forest economics and taxation will be held on the morning of November 19.

The program chairman is Ralph Marquis, Northeastern Forest Experiment Station, 102 Motors Avenue, Upper Darby, Pa.

The co-chairman is J. Miles Gibson, Department of Forestry, University of New Brunswick, Fredericton, N. B., Canada.

Wood Utilization

A technical session on wood utilization will be held on the morning of November 20.

The program chairman is J. H. Jenkins, Forest Products Laboratory, Isabella Street, Ottawa, Ont., Canada.

The co-chairman is R. C. Fraunberger, Southeastern Industries Inc., Tioga and C Streets, Philadelphia 34, Pa.

Recreation, Wildlife and Range Management

A technical session on forest recreation, wildlife management, and range management will be held on the morning of November 20.

The program chairman is Edward P. Cliff, Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

The co-chairman is C. H. D. Clark, Royal Ontario Museum of Zoology, 100 Queens Park, Toronto 5, Ont., Canada.

Public Relations

A technical session on public relations in forestry will be held on the morning of November 20.

The program chairman is Ralph Unger, College of Forestry, State University of New York, Syracuse 10, N. Y.

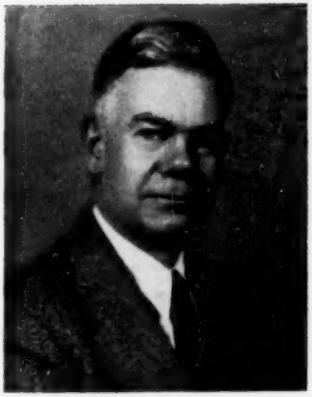
The co-chairman is M. R. Wilson, Canadian International Paper Company, Sun Life Building, Montreal 2, P. Q., Canada.

Social Activities

Plans are being made for a luncheon of the two societies on November 18. It will be an informal affair designed to get those in attendance better acquainted with their colleagues from both sides of the border. Mr. Fensom will preside.

A reception and banquet with an estimated attendance of nearly 1,000 will be held on the evening of November 19. In addition to an address by one of Canada's outstanding educators and public speakers, there will be special awards made for oustanding achievement in forestry. President George L. Drake will present two awards in behalf of the S.A.F.—the Sir William Schlich Memorial Medal and the Gifford Pinchot Medal. These are to be surprise presentations; the recipients will not be announced until the night of the banquet.

As is customary at S.A.F. meetings, an evening (November 18) has been set aside for dinners and meetings of the forestry school alumni groups and other informal get-togethers. On this evening there will also be a showing of forestry motion pictures.



HARDY L. SHIRLEY
Program Vice Chairman

A committee is at work planning activities for visiting ladies. Among other events there will probably be a ladies' luncheon and a special tour of interesting and historical places in Montreal.

Side Trips

A special committee is preparing information about points of interest along main travel routes to Montreal so that members may make premeeting or postmeeting side trips. Later announcements will give the specific location of mills, forestry operations, and laboratories, with instructions as to when and how to get to them.

Hotels in Montreal

There are numerous good hotels in Montreal and an adequate number of rooms is assured.

Subsequent issues of the JOURNAL will contain a list of the cooperating hotels with their rates. All hotels listed will be within a 10-minute walk of the Mount Royal, the headquarters hotel.

Members in Armed Forces Eligible for Inactive Status

Members now serving in the armed forces may apply for inactive status during such military service if they wish, but most prefer to maintain contact with their profession.

An inactive member does not pay dues, nor does he receive the Society's publications. Active status may be resumed upon his return to civilian life by the payment of current dues.

S.A.F. Committee on Manpower

At the mid-year meeting of the Council of the Society on June 4-5, 1951, President Evans appointed a Committee on Manpower. The responsibilities of this committee are similar to those of a like committee active during World War II. The new committee's task is to collect information on the various functions foresters perform in the national economy and to determine the importance of these functions in times of peace and in times of military emergency. The committee met at the Biloxi meeting and defined its job as follows:

1. To keep informed on current rulings affecting technical manpower as issued by Selective Service, Defense Manpower Administration, and Military authorities governing recall of reservists.

2. To prepare appropriate material on the importance of foresters and forest products to the defense program.

3. To collect information on the supply and demand for foresters and the need for including forestry among critical professions.

4. To keep the profession informed on manpower rulings of government, and to answer inquiries by members.

5. To inform the Society of American Foresters Council of need for actions relating to use of foresters in the over-all defense program.

The committee considered the need for including foremen and laborers engaged in forestry and forest industries within its purview but decided to exclude them. It was deemed that the forest products industries and state and federal agencies employing such personnel could speak more authoritatively in their behalf.

The committee is tentatively including range, wildlife, and recreation managers with foresters, subject to confirmation from organizations representing these specialists of their desire that we do so. Your committee has already met with a manpower committee of the Forest Products Research Society and arranged for mutual cooperation in our undertaking. The committee welcomes suggestions from members that will be helpful to it in carrying out its functions.

The members of the committee are: John F. Shanklin, Paul Schoen, Fred H. Miller, George W. Dean, Henry Bahr, and Hardy L. Shirley, chairman.

A Request for Assistance

The Society of American Foresters has recognized the need by practicing foresters for a more comprehensive knowledge of natural developments within virgin forest associations. To provide the basis for obtaining first-hand data on such natural developments, adequate samples of every forest type recognized by the Society are required. A survey of this situation disclosed that the virgin type associations are inadequately represented in the natural areas accepted for listing by the committee.

Analysis of Society of American Foresters objective. — One of the principal objectives of the Society in this field is to be certain that an adequate number of samples of every recognized forest type is pre-

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Dear Foresters:

Perhaps you will pardon a modest enthusiasm on my part for my new Improved B-10 Tree Stick. I have just received them from the Canadian manufacturer. They are selected maple; very good workmanship.

The B-10 Tree Stick uses Basal Area methods for obtaining tree volumes and growth information.

So far as I know, it is the only pulpwood stick on the market. Volumes in cords or units of rough or peeled wood and solid cubic feet are easy to obtain for tree heights 30 to 100 feet by 10 foot intervals. Timber markers can tally volumes as the trees are marked.

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Two practical helps in determining Form Class are on the Stick. Do you know that raising the Form Class from 80 to 82 makes 5% difference in the estimate?

Basal area becomes so easy with the Stick that you can answer expert questions in a hurry.

When does a tree of certain diameter double in volume? The Stick and a little judgment gives the answer at a glance.

How many board feet, lumber scale, does a tree of given diameter grow in a year? Another practical and quick answer is given by the Improved B-10 Tree Stick.

How many board feet is a given acre growing this year? A conservative and quick answer is possible if you are familiar with local growth conditions.

The Stick length makes for more accurate diameter and many quicker height and merchantable length readings than with other Sticks that I know about.

The Improved B-10 Stick and a leaflet will be delivered to you for $3.00 less 10% in quantities of 10 or more. I have 3,000 of them. How many do you want?

Sincerely,

Zachary, La. Fred B. Merrill,

served in a virgin state within qualified natural areas. It has not been easy to find a quick and complete answer to how to achieve such an objective. The committee discarded any thought of suggesting that the Society itself enter the land ownership field even though funds might be found for such a purpose. It believes that the Society should depend on public and private agencies administering forest lands to take the necessary action to set aside forest areas which may qualify under the Society's definition of a natural area and the committee's standards for size of forest type and permanence of protection afforded.

Accordingly, the initiative rests with the committee to urge forest land owners to cooperate in this program. It is with such an idea in mind that the committee has been considering how to arouse real and sustained interest in this undertaking.

To fulfill the entire objective every forest type should be set aside eventually within recognized natural areas. However, consideration was given to dividing the objective into several segments and emphasizing only a few of the types at a time. Hence a priority system has been developed which focuses attention on certain types as being of major importance to forest managers. It is recognized that the committee is on insecure ground to indicate any preferences as to forest types as in the end all types are probably of equal importance if all ecological and research viewpoints are considered. However, the priority system is simply a procedural device whereby the final goal is divided into intermediate goals.

Priority system.—For the purposes of arriving at a priority system, however imperfect, three criteria were utilized, namely: (1) commercial importance, (2) distribution, and (3) permanence. With these as a basis twelve groups were developed, viz:

1. High commercial value, widespread and permanent
2. High commercial value, widespread and subclimax
3. High commercial value, restricted and permanent
4. High commercial value, restricted and subclimax
5. Medium commercial value, widespread and permanent
6. Medium commercial value, widespread and subclimax
7. Medium commercial value, restricted and permanent
8. Medium commercial value, restricted and subclimax
9. Low commercial value, widespread and permanent
10. Low commercial value, widespread and subclimax
11. Low commercial value, restricted and permanent
12. Low commercial value, restricted and subclimax

An examination of the types found within qualified natural areas and segregated in accordance with those twelve groups shows that we are much better off in the western United States than in the eastern United States towards getting a good representation of the forest types recognized by the Society. Secondly, the natural areas so far established show a higher representation of high priority types than of low priority types.

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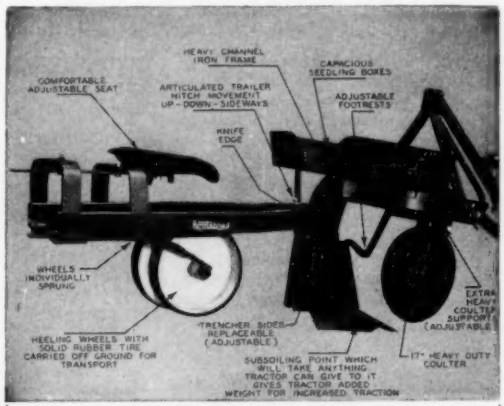
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Types inadequately represented. —Treating only with the top four groups it has been ascertained that the following forest types are not adequately represented in the present system of natural areas.

1. High commercial value, widespread and permanent:

   Eastern:

   Type No. 14 Sugar maple
   Type No. 17 Red spruce—sugar maple—beech
   Type No. 33 Scarlet oak—black oak
   Type No. 50 White oak
   Type No. 57 Beech—sugar maple
   Type No. 77 Red gum — yellow poplar

   Western:

   Type No. 245 Pacific ponderosa pine

2. High commercial value, widespread and subclimax:

   Eastern:

   Type No. 34 Southern red oak—scarlet oak
   Type No. 38 Shortleaf pine
   Type No. 46 Eastern red cedar
   Type No. 63 Longleaf pine
   Type No. 68 Loblolly pine—shortleaf pine
   Type No. 71 Loblolly pine—white oak
   Type No. 72 Loblolly pine—slash pine
   Type No. 90 Southern white cedar

3. High value, restricted and permanent:

   Eastern:

   Type No. 24 Northern white cedar
   Type No. 49a White oak—black oak—hickory

   Western:

   Type No. 232 Redwood

   Transcontinental:

   Type No. 21, 202 White spruce—birch

4. High value, restricted and subclimax:

   Eastern:

   Type No. 8 White pine—red oak—white oak
   Type No. 20 Paper birch — red spruce—balsam fir
   Type No. 53 Yellow poplar

Conclusion. — Forest managers are requested to analyze the forest property for which they are responsible to determine whether they have any of the forest types listed above which would:

(1) Meet the Society's definition:

Natural Area. An area set aside to preserve permanently in unmodified condition a representative unit of the virgin growth of a major forest type primarily for the purposes of science, research and education. Timber cutting and grazing are prohibited and general public use discouraged.

(2) Satisfy the committee's standards:

Minimum acreage of a single type shall be not less than ten acres provided it is surrounded with an equal acreage of forest land to constitute a buffer zone. Protection shall be provided permanently through an act of legislation, regulation, endowment, trust, will or otherwise.

The committee will appreciate having the following information supplied for every natural area submitted for its consideration:

a. Name of Natural Area
b. Location—state and county
c. Acres of Natural Area
d. Acres of each cover type within the Natural Area
e. Protection agency
f. Permanence afforded through what means

JOHN F. SHANKLIN,
Chairman, Committee on Natural Areas.

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New York Section Meeting

The New York Section held its winter meeting in Brubacher Hall on January 24th and 25th as guest of the New York State College for Teachers in Albany. The excellent facilities of the new hall contributed much to making this one of the outstanding winter meetings of the Section.

The meeting was called to order by Chairman Albert J. Woodford, who after welcoming remarks, turned the chair over to Fred Winch for the morning session. David Cook ably filled in for E. W. Littlefield in the same capacity for the afternoon session.

Outgoing chairman Albert J. Woodford, *left*, hands the gavel to Fred Winch, Jr., newly elected chairman of the New York Section.

The day was devoted to the presentation of papers which dealt with the planting, silvicultural, economic, and management problems of spruce both as a plantation tree and as natural growth.

E. J. Elinson acted as toastmaster at a banquet in Albany's Trinity Methodist Church at which Norman Rockwell entertained about 125 foresters with an interesting talk relative to his work as an illustrator.

Several door prizes (donated through Tom Burton of the D. B. Smith Company) were awarded to foresters holding lucky numbers and to those having the largest number of children and grandchildren.

The second day of the meeting was devoted to the business session. Starting with the reports of the chairman and secretary-treasurer, there followed several committee reports, after which an election of officers was held.

Fred W. Winch, Jr. of Ithaca was elected chairman for the next two years. John Stock of Conifer was elected vice-chairman, and C. E. Farnsworth of Syracuse was named to the executive committee.

Lively presentation of opinion, relative to the satisfactory wording of a resolution favoring Conservation Commissioner Duryea's action of opening discussion on the fulfillment of the intent of Article XIV, Section 1 of the Constitution of the State of New York, took up most of the time of this session. This article refers to the "forever wild" character of Forest Preserve lands which has been a controversial issue for several decades. Thus with an air of having completed a job to the satisfaction of the majority membership, and with the gavel in the hands of the new chairman, the winter meeting of the Section was moved to adjournment.

Charles E. Boone,
Public Relations Committee.

Intermountain Section to Meet

The annual meeting of the Intermountain Section will be held April 12 at Logan, Utah in the Rural Arts Building of Utah State College.

Chairman of the Program Committees is H. L. Lobenstein, U. S. Forest Service, P. O. Box 669, Ogden, Utah.

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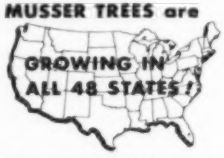

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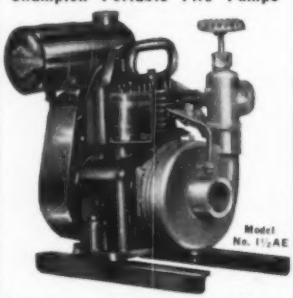

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Allegheny Section Meeting

The annual winter meeting of the Allegheny Section was held at Hotel William Penn, Pittsburgh, Pa. February 14-16. The meeting was held in Pittsburgh in order to give the members living in western Pennsylvania, West Virginia, and Maryland an opportunity to attend a winter meeting in their locality. The members responded with a registration close to 200.

The two accredited forestry schools located in the Section, Penn State and West Virginia, were represented by a total of 41 students and professors.

Dr. R. P. True, University of West Virginia, Department of Plant Pathology and Bacteriology gave an illustrated talk on the oak wilt in the Allegheny Section.

A paper, "Pennsylvania Conservation Law: Its Effect on Private Industry" was given by Dr. W. F. Schulz, University of Pittsburgh Law School. Claude A. Zehner, director of Production and Marketing Administration for Pennsylvania, spoke on "Conservation Payments, An Aid to Private Forestry." D. B. Frampton, president of D. B. Frampton Company, talked on "Forestry and the Integrated Utilization of Forest Products."

Toastmaster at the annual banquet was H. C. Buckingham of the Maryland Department of State Forests and Parks. One of the honored guests, Fellow F. W. Besley, gave out the door prizes: the customary Indian fire pump and Kurfew cruising scale, and SAF tie chains, buttons, and lapel pins, and copies of the Code of Ethics. Mr. Besley celebrated his eightieth birthday during the meeting. The Section was also honored to have George L. Drake, the new president of the Society present for the entire meeting, along with Executive Secretary, Henry Clepper.

L. S. Hartley, manager, Agriculture Development, Baltimore and Ohio Railroad, was the banquet speaker.

Two panel discussions, one on "Pulp and Paper Companies Practice Forestry" and the other on "Saw Mill Companies Practice Forestry," were held.

New officers were elected and installed: Chairman Durrell E. Hess; Vice-Chairman Adna R. Bond; Secretary-Treasurer Harvey R. Frantz; and Executive Committee members David P. Worley and A. N. Lentz.

Columbia River Section to Hold Field Meeting

A field meeting to nearby interesting private and public forest operations has been scheduled by the Columbia River Section on May 17 at Eugene, Oregon.

The Willamette Chapter, one of the Section's seven chapters, will be host for the meeting. All S.A.F. members are cordially invited to attend. The theme of the meeting is "Integrated Uses of Forests."

The chairman in charge of arrangements is Boyd Rasmussen, U. S. Forest Service, Corvallis, Oregon.

Candidates for Membership

Candidates for admission (except those for the Student Member grade), advancement, or reinstatement whose membership applications were received in the Society office during the month of February are listed below.

Action regarding the eligibility of these candidates will be taken by the Council as of May 1, 1952. Any communications from voting members relating to the membership eligibility of any of these candidates should be received in the Society office prior to that date.

The names of these candidates who become members of the grade for which they have applied will be published in subsequent issues of the JOURNAL OF FORESTRY.

Allegheny Section

Junior Grade

Babbitt, R. P., Ext. Asst., West Va. Pulp and Paper Co., Tyrone, Pa.; Univ. of Mass., B.S.F., 1950.

Case, F. M., Secy.-Treas., F. P. Case and Sons, Inc., Troy, Pa.; Pa. State, B.S.F., 1938.

Guegold, F. F., 3814 La Belle Ave., Wheeling, W. Va.; Colo. A & M., B.S.F., 1950.

Harding, M. J. Regional Forester, Pa. Dept. Forests and Waters, Clarion, Pa.; Pa. State, B.S.F., 1938. Reinstatement.

Middleton, J. B., Advanced Highway Forester, Pa. Dept. Forests and Waters, Uniontown, Pa.; Pa. State, B.S.F., 1950.

Ross, R. E., Forester, Fisher and Young Lbr. Co., Titusville, Pa.; State Univ. of N. Y., B.S.F., 1950.

Member Grade

Brockmann, R. L., Cons. Forester, Meadville, Pa.; Pa. State, B.S.F., 1939. (Junior, 1945).

Lyman, R. R., Forester, W. Va. Pulp and Paper Co., Coudersport, Pa.; Pa. State, B.S.F., 1919. (Junior, 24R42).

Underwood, J. A., Agent, U. S. Steel Co., East Springfield, Pa.; Pa. State, B.S.F., 1932. (Junior, 1932).

Ward, W. W., Instructor, Pa. State College, Mont Alto, Pa.; Pa. State, B.S.F., 1940; M.F., 1952. (Junior, 42R49).

Central Rocky Mountain Section

Member Grade

Johns, D. S., Thr. Sales Asst., U.S.F.S., Dolores, Colo.; Pa. State, B.S.F., 1940. (Junior, 1945).

Central States Section

Junior Grade

Meder, A. O., Pilot Plant Supv., Koppers Co., Inc., Orrville, Ohio; Pa. State, B.S.F., 1940.

Nelson, C. N., Dist. Log Buyer, Chester B. Stem, Inc., New Albany, Ind.; State Univ. of N. Y., B.S.F., 1950.

Thompson, L. S., Highway Forestry Foreman, Mich. State Highway Dept., Cadillac, Mich.; Mich. State, B.S.F., 1950.

Affiliate Grade

Aho, E. W., Forester Mgr., Woodland Owners' Coop. of Peoria, Inc., Peoria, Ill.; Mich. College of Mining and Tech., B.S., (Forestry), 1948.

Associate Grade

Coulter, L. L., Research Agronomist, Dow Chemical Co., Midland, Mich.; Mich. State College, M.S., (Horticulture), 1943.
Farlow, P. R., Gen. Agric. Agent, Illinois Central R.R. Co., Chicago, Ill.; Iowa State, B.A., 1917.

Columbia River Section

Junior Grade

Colee, E. B., Logging Mgr., Dalles Lbr. and Mfg. Co., The Dalles, Oreg.; Oregon State, B.S.F., 1942.

Member Grade

Andreassen, W. K., Logging Supt., Long-Bell Lbr. Co., Eugene, Oreg.; Univ. of Wash., B.S.F., 1940. (Junior, 1945).
Foster, C. L., Forester, Long-Bell Lbr. Co., Eugene, Oreg.; Oregon State, B.S.F., 1939. (Junior, 1945).
Hermann, A., Research Engr., Western Pine Assoc., Portland, Oreg. (Junior, 37R51).
Lound, F. E., Forester, Edward Hines Lbr. Co., Hines, Oreg.; Oregon State, B.S.F., 1941. (Junior, 1945).
McDonald, J. E., Forest Supv., U.S.F.S., Lakeview, Oreg.; Utah State, B.S.F., 1939. Reinstatement.

Affiliate Grade

Kobelin, D. W., Forestry Aide, U. S. Bureau of Land Mgt., Bend, Oreg.; Wash. State College, B.S.A., 1951.

Gulf States Section

Junior Grade

Blair, E. A., Service Forester, La. Forestry Comm., Hammond, La.; La. State Univ., B.S.F., 1949.
Kent, N. C., Crystal Springs, Miss.; A.P.I., B.S.F., 1951. (Student, 1951).
Morris, D. J., Asst. to Board Mill Supt., Flintkote Co., Meridian, Miss.; Iowa State, B.S.F., 1935; Mich. State, M.S., 1939. Reinstatement.
Palmant, E. H., Research Forester, U.S.D.A., Vicksburg, Miss.; Mich. State College, B.S.F., 1950.

Member Grade

Sessions, L. C., Asst. State Forester, Miss. Forestry Comm., Jackson, Miss.; La. State Univ., B.S.F., 1934. (Junior, 34R51).

Affiliate Grade

Bond, W. L., Gen. Tbr. Supt., Allen Coop. Co., Jackson, Miss.
Freeman, J. C., Jr. Forester, Kirby Lbr. Corp., Cleveland, Texas; Okla. A & M., B.S., (Forestry), 1951.
Jeter, C. H., Vice Pres., A. J. Hodges Industries, Shreveport, La.; Okla. A & M., B.S., (Animal Husbandry), 1930.

Inland Empire Section

Junior Grade

Hunt, L. D., Forester, Potlatch Forests, Inc., Headquarters, Idaho; Univ. of Idaho, B.S.F., 1950.
Silvernale, C. W., Forester, U.S.F.S., Grangeville, Idaho; Mont. State, B.S.F., 1949.
Walker, W. R., Forester, Potlatch Forests Inc., Headquarters, Idaho; Mont. State, B.S.F., 1949; M.F., 1950.

New England Section

Junior Grade

Merchant, G. C., Forester, Int. Paper Co., North Stratford, N. H.; Univ. of Me., B.S.F., 1950.

Member Grade

Bessey, E. D., Jr., Pulpwood Buyer, E. D. Bessey and Son, Waterville, Me.; Univ. of Me., B.S.F., 1940. (Junior, 1945).

Northern California Section

Junior Grade

Eden, C. J., Asst. Forest Tech., State of Calif., Div. of Forestry, Davis, Calif.; Univ. of Calif., B.S.F., 1949.
Ewanoski, S., Forester, Glenco Forest Products, Elk Creek, Calif.; Iowa State, B.S.F., 1942.
Gauthey, L., Forester, U.S.F.S., North Fork, Calif.; Pa. State, B.S.F., 1948.

Member Grade

Helgeson, R. L., Forest Engr., Fibreboard Products Inc., Truckee, Calif.; Mont. State, B.S.F., 1941. (Junior, 1945).
May, R. H., Calif. Forest and Range Exp. Sta., Berkeley, Calif.; Univ. of Mich., A.B., 1929; Univ. of Calif., M.S., 1939. Reinstatement.

Northern Rocky Mountain Section

Member Grade

Jones, H. E., Chief, Bureau of Land Mgmt., Billings, Mont.; Mont. State, B.S.F., 1938. (Junior, 38R49).
Pomajevich, J. N., Forester, U.S.F.S., Thompson Falls, Mont.; Mont. State, B.S.F., 1939. (Junior, 1944).

Ozark Section

Junior Grade

Plummer, J. L., Eminence, Mo.; Univ. of Mo., B.S.F., 1952. (Student, 1951).
Tinker, F. E., Field Asst., Int. Paper Co., Malvern, Ark.; Univ. of Ga., B.S.F., 1950; M.F., 1951.

Member Grade

Karow, K. F., Dist. Rgr., U.S.F.S., Springfield, Mo.; Univ. of Minn., B.S.F., 1939. (Junior, 39R42).

Puget Sound Section

Junior Grade

Banta, D. G., Engr. Crew, Ketchikan Public Utilities, Ketchikan, Alaska; Oregon State, B.S.F., 1951.
Dieterich, J. H., 4011 45th St., Seattle 5, Wash.; Colo. A & M., B.S.F., 1950.
Petzold, A. O., Asso. Forester, Simpson Logging Co., Shelton, Wash.; Pa. State, B.S.F., 1936. Reinstatement.

Member Grade

Lowrie, J. B., Forester, U.S.D.A., Enumclaw, Wash.; Univ. of Wash., B.S.F., 1940. (Junior, 1945).
Tucker, L. A., Adm. Asst., Wash. State Div. of Forestry, Olympia, Wash.; Wash. State College, B.S.F., 1940. (Junior, 1945).

Affiliate Grade

Meeley, J. M., Cons. Supt., Rayonier Inc., Sappho, Wash.

Southeastern Section

Junior Grade

Johnson, C. D., 310 High School St., Hartselle, Ala.; A.P.I., B.S.F., 1951. (Student, 1951).
Johnson, W. A., Forester, Richard Tift Co., Albany, Ga.; Univ. of Ga., B.S.F., 1943.
Sellers, J. D., Proj. Forester, Ala. Ext. Service, Greenville, Ala.; B.S.A., 1941. (Aff., 1950).

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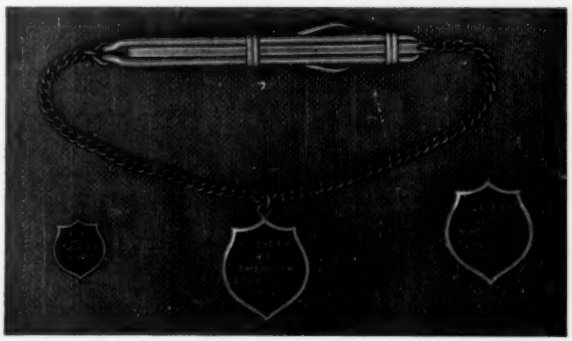

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Shumate, J. B., Dist. Forest Rgr., U.S.F.S., Luna, N. Mex.; Oregon State, B.S.F., 1947.

Member Grade

Schilling, E. A., Asst. Regional Forester, U.S.F.S., Albuquerque, N. Mex.; Colo. A & M., B.S.F., 1926. (Junior, 36R49).

Upper Mississippi Valley Section

Member Grade

Worrall, D. C., Forester, Halvorson Trees, Duluth, Minn. (Junior, 1945).

Associate Grade

Layton, R. J., Resident Mgr., Northwest Nursery Co., Valley City, N. Dak.

Washington Section

Junior Grade

Mercker, R. C., 3510 Runnymede Place, N.W., Washington, D. C.; Mich. State, B.S.F., 1951. (Student, 1951).

Roos, M., 3140 Wisconsin Ave., N.W., Washington, D. C.; Mich. State, B.S.F., 1949.

Member Grade

Hartman, F. J., Forest Inventory and Tbr. Mapping, Cartographics, Inc.; N. C. State, B.S.F., 1941. (Junior, 1945).

Pammel, H. E., Supt. of Grounds, U. S. Soldiers' Home, Washington, D. C.; Iowa State, B.S.F., 1922; State Univ. of New York, M.F., 1925. (Junior, 1942).

Associate Grade

Parker, D. E., Asst. Div. Leader, U.S.D.A., Washington, D. C.; Univ. of Mass., B.S., (Ento.), 1925.

Wisconsin-Upper Michigan Section

Junior Grade

Martin, F. R., Refuge Mgr., Necedah Natl. Wildlife Refuge, Necedah, Wis.; Mich. State, B.S.F., 1940. Reinstatement.

Valimaki, O. A., Traunik, Mich.; Univ. of Mich., B.S.F., 1951.

Wepfer, R. W., 2555-A N. Humboldt Ave., Milwaukee, Wis.; Univ. of Mich., B.S.F., 1952. (Student, 1951).

New Members and Advancements

Individuals who became members of the grades indicated during the month of February are listed below. They are eligible for participation in activities of the Society of American Foresters, including meetings and projects of Sections, Chapters, Divisions, and Committees.

Allegheny Section

Student Grade

PENNSYLVANIA STATE COLLEGE

Bowman, R. C. — Klinefelter, F. W.
Folsom, N. E. — Nelson, J. C.
Holdren, R. K. — Ruth, J. D.
Jones, R. E.

WEST VIRGINIA UNIVERSITY

Bobbs, D. E. — Hartmann, H. R.
Gatrell, T. L.

Junior Grade

Burr, H. L., Box 203, Summersville, W. Va.
Johns, W. D., U.S.F.S., Sheffield, Pa.
Kantz, B., Star Route, Selinsgrove, Pa.

Appalachian Section

Junior Grade

Renfro, J. F., Mountain Home, N. C.
Wood, G. W., Jr., 4929 Duke Sta., Durham, N. C.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Anderson, J. C.

Junior Grade

Alexander, R. R., 1102 Remington, Ft. Collins, Colo.
Nelson, J. A., 1015 S. Milwaukee Way, Denver, Colo.

Member Grade

Dickison, F. F., 3960 Curtis Ave., Omaha, Nebr.

Central States Section

Student Grade

PURDUE UNIVERSITY

Chilman, K. C. — Reed, M. O.
Lenox, J. T., Jr. — Troskey, F. T.

MICHIGAN STATE COLLEGE

Curtis, F. H. — Spelman, K. W.
Hayden, D. A. — Whitman, L. W.

UNIVERSITY OF MICHIGAN

Brooks, W. B. — LaDue, F. M.
Crumb, D. J. — Pappalardo, V. J.

Junior Grade

Cooley, J. R., Box 16, Corunna, Mich.
Fields, J. N., 1779 Beach St., Muskegon, Mich.
Korosi, J. J., 1818 LaPorte Ave., Whiting, Ind.
Marttila, U. M., 221 Stimson St., Cadillac, Mich.
Mohundro, W. M., 122 W. Arcadia, Peoria, Ill.
Nowak, C. R., Box 300, LaPorte, Ind.

Member Grade

Johnson, T. L., Box 241, Burton, Ohio

Affiliate Grade

Mudd, L. S., 823 N. Marion St., Oak Park, Ill.

Columbia River Section

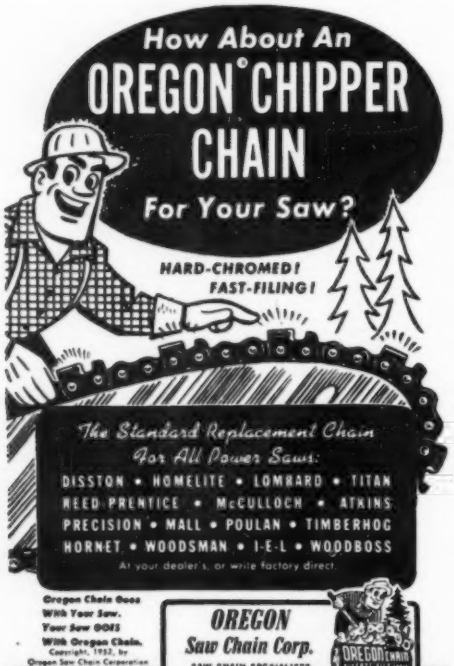
Student Grade

OREGON STATE COLLEGE

Brown, D. J. — Rogers, G. D.
Bobyns, W. L. — Season, J. A., Jr.
Gingery, D. H. — Trout, M. F.
Krogh, A. W. — Usher, V. H.

Junior Grade

Smith, J. H., 519 S. 14th St., Corvallis, Oreg.
Thomson, W. G., 1734 N.E. 55th Ave., Portland, Oreg.
Yantis, R. A., Box 349, Roseburg, Oreg.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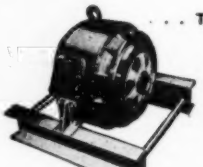

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Bengtson, G. W.
Breard, L. B.
Bryant, R. L.
Kitt, P. D.
Lawranson, T. B., Jr.
Wilkins, E. C.

Junior Grade

Carlson, N. A., Box 883, Keesler A.F.B., Miss.
Dykes, J. A., Ill. Central R.R., Baton Rouge, La.
Krier, J. P., Stephen F. Austin State College, Nacogdoches, Tex.
Whittemore, D. K., Box 1657, Fort Bliss, Texas

Member Grade

King, L. E., Jr., Huntsville, Texas
McDonald, L., 18 Tennessee Ave., Alexandria, La.

Affiliate Grade

Roseman, E. B., 808 E. Main St., Winnfield, La.
Broadhead, A. H., Pleasant Grove, Miss.
Ewing, E. R., Colfax Lbr. and Creo. Co., Pineville, La.
Henderson, J. W., Oakdale, La.
Tannehill, W. M., North Valley St., Winnfield, La.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Bay, R. R.
Estes, K. M.
Estheimer, C. R.
Gleaves, W. W.
Johnson, F. D.
Naab, W. P.
Scott, D. W.
Van Kleeck, R. T.
Walker, A. W.

Member Grade

Daugherty, C. I., Hailey, Idaho

Intermountain Section

Student Grade

UTAH STATE AGRICULTURAL COLLEGE

Clemens, D. I.
Gara, R. I.
Roll, T. A.
Smith, W. E.

Kentucky-Tennessee Section

Junior Grade

Hunt, E. V., Jr., Univ. of Tenn., Knoxville, Tenn.

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Dodge, A. G., Jr.

UNIVERITY OF MAINE

Gove, W. G.

YALE UNIVERSITY

Eggleston, R. M.
Grayson, F. L.

Junior Grade

Carr, F. X., Box 221, Middlebury, Vt.
Savage, E. T., 29 Grove St., Bangor, Me.
Wilson, P. A., 10 Chapman, Andover, Mass.

Member Grade

Hutton, R. G., Greenville, Me.
Shepard, H. M., 318 Main St., Calais, Me.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Bauerle, A. L.
Raney, D. W.

Junior Grade

Needham, P. E., 108 Buckingham, Syracuse, N. Y.
Shearer, T. D., 410 Folts St., Herkimer, N. Y.
Zugger, G. T., Jr., 300 Gold St., Buffalo, N. Y.

Member Grade

Belyea, H. C., State Univ. of New York, Syracuse, N. Y.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Busby, F. M.
Hansen, J. H.
Heasley, W. L.
Lyon, C. B.
Owens, H. B.
Payne, F. L.
Rotto, M. A., Jr.
Williams, C. L.

Junior Grade

Arment, C. R., 1014 Arnold St., Susanville, Calif.
Dake, C. G., Jr., Gen. Del., Glenwood, Calif.
Ludtke, D. F., 1733 Hamilton Ave., Palo Alto, Calif.

Affiliate Grade

Harris, R. F., Box 1326, Sonora, Calif.

Associate Grade

Frandsen, L., Southern Pacific Co., 65 Market St., San Francisco, Calif.

Northern Rocky Mountain Section

Student Grade

MONTANA STATE COLLEGE

Frizzell, M. M.
Prussing, F. W.
Waterman, C. J.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Davis, J. T.
Neebe, D. J.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Daub, H. A.
Farley, D. L.
Fredwall, R. M.
Hawley, G. S.
Hawes, P. L.
Kidwell, T. V.
Orr, P. W.
Strum, E. C.
Trappe, J. M.
Wanga, A. T.

Junior Grade

Olson, S. E., Box 265, Enumclaw, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Crown, W. L., Jr.
Philipp, A. H.

UNIVERSITY OF GEORGIA

Creech, G. L.
Churchwell, N. R.
Leonardi, S. A.
Marshall, C. M.
Moore, S. L.
Seymour, H. K.
Shain, W. A.
Thompson, W. N.
Vining, J. C., Jr.

Junior Grade

Champion, D. E., W. Liberty St., Claxton, Ga.
Dumas, K. W., Jr., International Paper Co., York, Ala.
Hill, A. L., Jr., Box 172, DeFuniak Springs, Fla.
Lloyd, C. W., 615 N.E. 2nd Ave., Fort Lauderdale, Fla.
Schrenk, G. M., Jr., 707 E. Rich Ave., DeLand, Fla.
Thrower, R. L., 517 Bailey St., Fairfax, Ala.

Affiliate Grade

Gaensehals, F., Box 86, Lockhart, Ala.

Southern California Section

Honorary Grade

Rosecrans, W. S., Dr., 1151 S. Broadway, Los Angeles, Calif.

Southwestern Section

Junior Grade

Dougherty, F. G., Heber Ranger Sta., Holbrook, Ariz.
Duran, G., Jr., U.S.F.S., Taos, N. Mex.
Lehnert, C. E., Box 224, Grand Canyon, Ariz.
Sweetnam, F. R., Box 34, El Rito, N. Mex.

Affiliate Grade

Johnson, C. F., Heber Rgr. Sta., Holbrook, Ariz.
Johnson, R. C., 1957 Kiva Rd., Santa Fe, N. Mex.

Upper Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Hanson, O. J.
Ritter, W. C.

UNIVERSITY OF MINNESOTA

Austbo, J. A.
Cross, D. S.
Cross, G. C.
Smith, C. L.

Junior Grade

Conover, D. F., P-59 Univ. Village, Minneapolis, Minn.

Affiliate Grade

Ayer, E. B., Box 31, Port Arthur, Ont., Canada.

Washington Section

Junior Grade

Carson, W. G., 2375 Champlain St., N.W., Washington, D. C.
Merritt, R. W., 3004 Parkway Terrace Drive, Washington, D. C.

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Forestry News

James W. Craig Appointed Mississippi State Forester

The Mississippi State Forestry Commission, in a meeting in Jackson on January 2, appointed James W. Craig as state forester. Craig succeeds Albert A. Legett who died December 13, 1951.

Known to his many friends as Jim, Craig received his Bachelor of Science Degree in Forestry from Purdue University in 1936. During the summers of 1936 and 1937, he served as instructor of dendrology and forest mensuration at the Purdue University sum-

JAMES W. CRAIG
. . . *Mississippi State Forester.*

mer camp. In 1938 he received his masters degree from the New York State College of Forestry at Syracuse and began work as research assistant, New York Department of Conservation, on the Rochester watershed at Springwater, N. Y. He was later promoted to the position of watershed forester for the City of Rochester.

In 1941 Craig entered active duty in the U. S. Army with the 32nd Division stationed at Camp Livingston, La. He served with this division as assistant inspector general and commanding officer. He was transferred to the job of billeting officer for the London Service Command, London, England and was later moved to assistant staff judge advocate, and served in this capacity for 18 months. His duties embraced prosecution and defense of individuals accused and tried under military law. Over 500 individuals were tried and defended by Mr. Craig during this time. Being promoted to head personnel officer G-1 for the London Service Command, Craig had supervision of approximately 750 officers and enlisted men and 2,000 British civilians. He served in this capacity until 1945 when he was returned to the States.

Upon his release to inactive duty with the rank of Lt. Col., Craig began work as assistant chief of forest fire control for the Mississippi Forest Service and was later advanced to chief, forest fire control and so served until he resigned to establish his own business as consulting forester in June, 1948.

Point 4 Program in Brazil

Keith Lowell Truettner, of Ann Arbor, Mich., forester and rubber plantation operator, has joined a Point 4 rubber development mission of the U. S. Department of Agriculture in Brazil.

He will aid in organizing and directing a rubber experiment station in Bahia, and will advise upon the development and management of a local rubber industry.

Truettner has bachelor's and master's degrees in forestry from the University of Michigan. He served as a rubber plantation manager in Liberia for more than two years until last September, and since has been a consultant in photogrammetry at the University of Michigan.

Albert Arnst Named Editor of The Timberman

Appointment of Albert Arnst as editor of *The Timberman* has been announced by Edgar P. Hoener, publisher of the 52-year-old lumber trade journal published in Portland, Oregon.

Mr. Arnst, who will be in complete charge of all editorial and editorial staff activities in planning, programming, and material preparation, has been associated with the Weyerhaeuser Timber Company at Tacoma, Wash. since July, 1946, serving under the director of public information, and since last October has been in charge of the Portland office of the Department of Public Information opened at that time.

He was responsible for beginning Weyerhaeuser's long-range program of informational activities in Washington and Oregon. These responsibilities included news and feature writing, special publications, photographic projects, copy for newspaper advertising, contact work with groups and associates, special project planning, legislative contacts, and talks to groups. Mr. Arnst helped to de-

ALBERT ARNST
. . . *Timberman editor.*

velop many of the techniques now standardized and in use by the Weyerhaeuser Timber Company in its program, which has been recognized nationally.

Previous to joining Weyerhaeuser Timber Company, he was associate editor of *The Timberman*, and served as well for five years with the U. S. Forest Service in the Portland regional office, and eight years with the Soil Conservation Service in Oregon and Washington.

A graduate with a B.S. degree in forestry from Oregon State College in 1931, in his senior year he was editor of the *Annual Cruise* and chosen for membership in Xi Sigma Pi, honorary forestry fraternity, and Phi Kappa Phi, all-school honorary fraternity.

He is chairman of the Division of Public Relations of the Society of American Foresters.

Washington Governor's Dinner

To inaugurate the 1952 fire season, the Washington Keep Green Association and the Puget Sound Section, Society of American Foresters, are jointly sponsoring the Annual Governor's Dinner to be held at the Seattle Chamber of Commerce on Friday, April 11.

Fire prevention will be the keynote, and Governor Arthur Langlie will be the principal speaker.

Samuel N. Spring (1875-1952)

Samuel Newton Spring, dean emeritus of the New York State College of Forestry, died at Atlanta, Ga. on February 3. He would have reached his 77th birthday two days later.

Born in Sioux City, Iowa on February 5, 1875, he subsequently attended Yale University, receiving the A.B. degree in 1898 and, after employment as a student assistant in the Bureau of Forestry (now the U. S. Forest Service), the M.F. degree in 1903.

During the period 1903-1905, he was professor of forestry and head of the Department of Forestry at the University of Maine, from which position he resigned to return to the Forest Service as chief of the Office of Forest Extension. Appointed in 1909 as forester for the Connecticut Agricultural Experiment Station and State forester, he also served as lecturer at the Yale School of Forestry.

Called to the forestry faculty as professor of silviculture at Cornell in 1912, he continued at the university for two decades except for brief periods as a visiting professor at Yale in 1917 and at the University of Missouri in 1919.

In 1932 he was named assistant dean of the New York State College of Forestry at Syracuse, and in February 1933 he was appointed dean, succeeding the late Hugh P. Baker who had been elected president of Massachusetts State College. Dean Spring continued as head of the college until 1944, when on his retirement Syracuse University conferred upon him the honorary degree of doctor of laws.

Samuel N. Spring

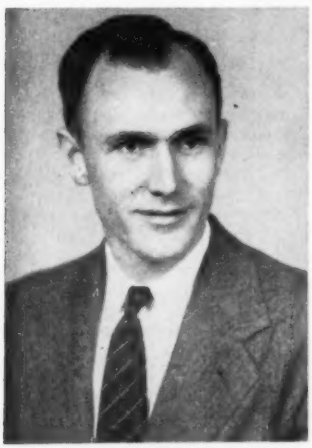
Dean Spring was a writer of ability and, though not prolific in output, he contributed numerous articles and bulletins to the literature of forestry. He was co-author of the book *Forestry*, a study of economic problems in forestry in the United States, published in 1929.

Admitted to membership in the Society of American Foresters in 1904, Dean Spring was elected a Fellow in 1939. Always active in Society affairs, he served as chairman of the New York Section in 1928-1930, and as a member of the Council for three terms during the period 1934-1937. He was also a former director of the American Forestry Association.

R. D. Hostetter to Join Faculty at Oregon State College

Robert D. Hostetter, formerly assistant executive secretary of the Society of American Foresters, is now working on a forestry assignment with the Weyerhaeuser Timber Co. at Centralia, Wash. He will join the faculty of the School of Forestry, Oregon State College, at Corvallis, in the fall to teach forest management.

Mr. Hostetter is a forestry graduate (1941) of Colorado A & M College, and was awarded the M.F. degree by Duke University in 1943.



Robert D. Hostetter

He was employed by the Tennessee Valley Authority when he was appointed assistant executive secretary of the Society of American Foresters in May 1948. While with the Society he handled membership matters, compiled the Society Affairs department of the Journal of Forestry, and worked closely with the Sections and Chapters in the development of their professional activities. He also prepared the *Section Manual*, a handbook of procedures and regulations for the use of Section officers.

Through his writings and personal contacts with S.A.F. members, Mr. Hostetter is widely known throughout the profession.

Insect Laboratory Established

A forest insect laboratory has been established at Liberty, Tex. Operated by the Forest Insect Investigations division of the U. S. Bureau of Entomology and Plant Quarantine, its work will be concerned with studies of forest insects in Arkansas, Louisiana, and Texas.

J. F. Coyne, entomologist, is in charge of the laboratory, a sub-station of Forest Insect Investigations Laboratory at Gulfport, Miss. Coyne was formerly located at Gulfport. He was assigned to forest insect investigation work in Texas in June 1951, although actively engaged on insect problems in that area since November 1950.

The outbreak of the southern pine beetle in Texas during the summer of 1950 killed an estimated 50 million board feet of sawtimber and 30,000 cords of pulpwood. This prompted the establishment of the insect laboratory. Studies will center on reasons for occurrence and subsidance of epidemics, including the life histories of destructive forest insects.

The insect laboratory at Liberty was established largely through the efforts of the Texas Lumber Manufacturers Association which purchased the site and constructed the building to house an office and laboratory facilities.

The Texas Forest Service has cooperated with the Texas Lumber Manufacturers Association and the Forest Insect Investigations division in the construction of the insect laboratory.

Marler, District Forester, Va.

Raymond L. Marler has been named district forester, Virginia Forest Service, Salem, replacing G. H. Hodge, who died, December 17.

Marler has been with the Virginia service for 3½ years. He attended the University of Wisconsin and the University of Michigan. He received both his B.S.F. degree and M.F. degree at Michigan.

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STATE FORESTER SWORN IN—Fred H. Claridge, (*second from left*) is shown taking the oath in Raleigh, as North Carolina's state forester. Claridge first joined the Forestry Division of the North Carolina Department of Conservation and Development in 1925 following his graduation from the Yale University School of Forestry. He succeeds W. K. Beichler. Administering the oath of office is Associate Justice M. V. Barnhill of the North Carolina Supreme Court, (*fifth from left*). Gathered to pay honor to Claridge and to witness his swearing in are, *left to right*: Don Johnston of Wake Forest, N. C., president of the American Forestry Association, Dr. C. F. Korstian, dean of Duke University's School of Forestry, Dr. R. J. Preston, dean of North Carolina State College's School of Forestry, and Roger W. Wolcott of Raleigh, president of the North Carolina Forestry Association.

Southern Pine Industry Meets

Featuring the progress of southern forestry, sessions by committees and talks by outstanding speakers, the Southern Pine Association will hold its annual meeting in New Orleans on April 7 to 9.

Among the speakers who will headline the program at the Roosevelt Hotel are: Dr. Arthur A. Smith, widely-known lecturer and writer on economies; Thurman Sensing, executive vice-president of the Southern States Industrial Council, and Arthur A. Hood, editor of the *American Lumberman*. Other leaders will give talks on such subjects as forest conservation, lumber procurement, wood recovery at sawmills, and additional topics.

E. O. Lightsey, president of the Association, will open the general session on Monday, April 7, when he gives his president's message. Mr. Sensing will speak on "The South of 1952," and Mr. Hood's topic will be "Market Opportunities." Their speeches will follow a preview of the convention by Mr. Berekes.

An industry-wide meeting will be held under the auspices of the Southern Pine Industry Committee. R. M. Eagle, chairman of SPIC, will preside.

Brig. Gen. A. W. Pence, assistant chief of engineers for military supply and procurement, will speak on lumber procurement, followed by a statement from Robert N. Denham, former general counsel of the National Labor Relations Board. An official from the Office of Price Stabilization also will address the meeting.

The morning session on April 8 will be centered around the theme, "Progress of Private Forestry in the South." Among the speakers and messages will be: Q. T. Hardtner, chairman of SPA's forestry committee, "Reflections of a Southern Pine Manufacturer;" Reuben B. Robertson, Champion Paper and Fibre Company, "The Pulp & Paper Industry's Part;" Fred H. Lang, Arkansas state forester, "How It Has Helped State Forestry;" I. F. Eldredge, Sr., forest consultant, "Observations of a Consulting Forester," and others.

In the afternoon, a panel discussion will be held on the morning session's forestry theme, with the forestry speakers participating. Questions will be presented to the panel.

At the president's banquet, April 8, Dr. Arthur Smith, vice president and economist of the First National Bank of Dallas, will speak.

The April 9 general session will be an open meeting of the SPA board of directors. The subjects to be covered include: "A Recommended Program of Expanded Trade Promotion;" "Transportation Problems Today," "Organized Labor's Progress in the Southern Lumber Industry," "Progress of Private Forestry in the South," and "The NLMA Program."

The meeting Wednesday afternoon, April 9, will see a program centered around the theme, "Mechanical Efficiency in the Southern Pine Industry."

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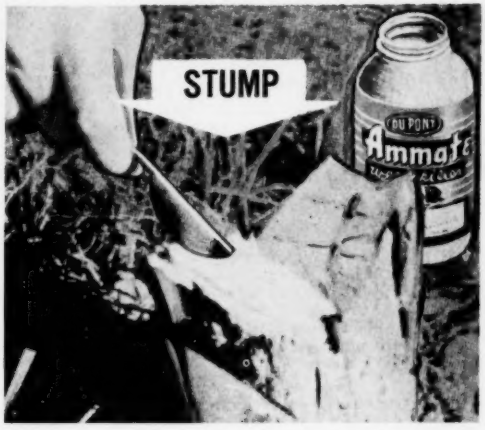

3 Cut small trees with a V-shaped stump. Put a tablespoonful of "Ammate" crystals in the V. You can also use "Ammate" on larger stumps to prevent sprouting.

2 On tough trees, chop notches every six inches near the ground. Put a tablespoonful of "Ammate" crystals in each notch. This deadens even blackjack oak with little resprouting.

4 On seedling trees or sprouts, spray the green leaves and stems when they are fully leafed out using "Ammate," ¾ lb. per gallon of water. Let trees or sprouts stand a year for best kill.

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By H. P. BROWN, State University of New York; A. J. PANSHIN, Michigan State College; and C. C. FORSAITH. *American Forestry Series.* 783 pages, $10.00

The companion volume to *Structure, Identification, Defects, and Uses of the Commercial Woods of the United States,* this text is divided into three parts which treat the physical, mechanical, and chemical properties of commercial woods. Derivations of almost all of the equations used in measuring the physical and mechanical properties of wood are given. Recent advances are included.

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New Chemicals from Turpentine

New chemicals showing excellent promise for use in the preparation of synthetic rubber, plastics, and many other products have been developed from gum turpentine by the U. S. Department of Agriculture. Samples for evaluation are available from the Naval Stores Research Division, U. S. Bureau of Agricultural and Industrial Chemistry, Olustee, Fla.

Recent tests by commercial concerns indicate that these chemicals (called terpene hydroperoxides) are particularly suitable for use as catalysts to speed the production of "cold rubber," that is, of synthetic rubber made at relatively low temperatures.

The commercial production of these new chemicals, using gum turpentine as the raw material, would open new markets to the gum naval stores industry. At the same time, the use of gum turpentine for this purpose would help to conserve the short supply of benzene, at present the raw material for the most widely used catalyst for "cold rubber," as well as for other critical products.

One of these new terpene hydroperoxides, pinane hydroperoxide, is particularly promising, not only because it is a superior catalyst, but also because it can be produced in exceptionally high yields with relative ease.

Menthane hydroperoxide, a commercially available chemical having properties similar to those of pinane hydroperoxide, also has been produced from gum turpentine by the Naval Stores Division. Menthane hydroperoxide can be produced from either gum turpentine or wood turpentine. Another possible source is limonene, a byproduct of the citrus processing industry obtained in the production of frozen or canned citrus fruit juices.

The production of terpene hydroperoxides from gum turpentine is not complicated. Only two steps are required to make pinane hydroperoxide in concentrations of 50 percent. First, the naturally occurring unsaturated pinenes in gum turpentine are converted to pinane, a saturated compound, by catalytic hydrogenation—a process that can be carried out in the same kind of equipment, by the same procedures, and with the same catalyst used for the production of hydrogenated cottonseed oils for oleomargarine and shortenings. The pinane thus obtained from gum turpentine is subjected to oxidation in the second, and final, step in the production of pinane hydroperoxide.

Southern Forests Stimulate Southern Economy

Ranking first in the number of active plants and second in the number of employees, the southern lumber industry is helping set the pace for manufacturing industries of the South, according to H. C. Berckes, secretary-manager of the Southern Pine Association.

A report on the southern lumber and timber industries released in February by the association shows that 34 percent of the industrial establishments in the South manufacture lumber products. More than 17,500 plants are devoted to lumber production. The SPA survey is based on figures published in *The Blue Book of Southern Progress*.

Pointing out that 369,000 persons are engaged in the manufacture of lumber and timber products, the report indicates that this is 15 percent of all industrial employees in the South. Only textile mills outrank it in the total persons employed.

Georgia ranks first among the 12 southern states in the number of active lumber establishments with 2,491 and also in the number of lumber employees, 45,000. North Carolina is second in both of these, with 2,276 plants and 44,000 persons engaged in lumber industries.

Typical of the SPA state tabulations is the one for Mississippi, whose lumber industry ranks first not only in the number of the state's plants and in the number of persons employed, but also in the value of active plants and in the income from payrolls and profits. Mississippi's lumber and timber products industry operates more than half of all industrial plants in the state.

AFPI Summarizes Decade of Progress

A decade of progress in practical forest management is measured in the annual report for 1951, published this month by American Forest Products Industries.

"During the year just ended forest production was at or near an all-time high in the United States," the report states. "This nation, with less than one-tenth of the earth's forest area, continues to produce more than two-fifths of the world's lumber and woodpulp and well over half of its plywood. Privately owned, tax-paying timberlands, operated under a free forest economy, provided nine-tenths of that wood harvest."

The report summarizes the growth of the industry-encouraged Keep Green program in forest fire prevention and points with pride to the nation's nearly 25,000,000 acres of certified Tree Farms.

The 16-page report, now being distributed in all 48 states, gives special attention to the work of forest industries in providing accurate and objective teaching aids for the nation's schools. Another section of the report covers forest industry activities in the field of public relations. The report states that 47 percent of the public and private schools of the United States have used AFPI-prepared teaching aids.

AFPI President James L. Madden, in a signed statement summarizing the report, says woodland owners are assured a dependable market for their tree crops in the years ahead.

"In modern day America, communities with adequate stands of green forests growing in their hinterland and with progressive industries to process their wood crops have a bright economic future," Mr. Madden, a New England pulp and paper company executive, declared. "It is a future Americans everywhere will share and enjoy. Let us insure our future with good forestry."

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Alaska Report Available

Long described as America's last frontier, Alaska's 586,400 square miles today constitute a great scientific laboratory, making it the North American continent's first frontier of Arctic and Subarctic research.

During the past six years, scores of scientists have studied the territory under sponsorship of the armed services, civilian government agencies, leading universities, research organizations, and private industry.

Evidence of the growing national and international scientific interest in Alaska is revealed in a 175,000-word volume covering proceedings of the Second Alaskan Science Conference held in September, 1951, at Mt. McKinley National Park, under the auspices of the Alaska Division, American Association for the Advancement of Science. Attending were more than 200 prominent scientists from Alaska, Canada, and the United States.

Containing more than 80 reports of studies in 20 scientific fields, the publication is believed to be the most comprehensive of its type ever devoted to Alaskan investigations. Principal fields represented are agriculture, forestry, medicine, physiology, public health, engineering, industrial sciences, geology, geography, sociology, economics, anthropology, geophysics, meteorology, wildlife, and zoology.

Copies of the publication are available from the Editorial Committee, Box 50, Juneau, Alaska. Cost of the volume is $2.

Company Dedicates Girdling Patent to Public Use

The Armstrong Forest Company, of Johnsonburg, Pa., has purchased patent rights for chemical girdling of trees from Alexander R. White of Port Arthur, Ontario. Mr. White held these rights under a U. S. patent granted in 1943.

According to the purchase agreement, the Armstrong Forest Company has dedicated the chemical girdling process to public use. The patent right purchase was completed January 10, 1952.

The Armstrong Forest Company has been experimenting with chemical girdling of pulpwood-size trees on its Pennsylvania woodlands for several years. Through use of a sodium-arsenite solution painted on a bark girdle, selected trees are killed on the stump. The bark on treated trees loosens in from three to seven months. Use of the chemical girdling treatment extends the bark peeling season.

Smith Succeeds Guy, Manager, Chamber Resources Department

Richard W. Smith has been named manager of the Natural Resources Department of the Chamber of Commerce of the United States. He succeeds David J. Guy, recently retired.

The department which Smith heads represents a broad range of natural resources industries, such as electric power, oil and gas, coal, lumber, and minerals.

Before his employment by the chamber in 1946, Smith was widely known as a geologist. He had been a specialist on the staff of the U. S. Bureau of Mines and had served as state geologist of Georgia. He also served as assistant state geologist for Tennessee.

Smith was graduated from Massachusetts Institute of Technology in 1921 and five years later received a master's degree in science from Cornell University.

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Harvest from Michigan State Forests

Michigan forests are showing signs of coming of age, with the Michigan Department of Conservation disclosing a record 57,979,000 board feet of pulpwood and timber logged from state forests last year. About 43,500,000 board feet was the 1950 harvest total.

Cutting permit receipts from state forests, almost exclusively tax-reverted land, tallied a record $267,656 as compared to $179,927 in 1950. Approximately 85 percent of the funds will be plowed back into the department reforestation program and the remainder will go into the game protection and general funds.

Forest Resources of Liberia

Liberia contains several forest areas which offer good opportunities for moderate development, according to Agricultural Information Bulletin No. 67, *Forest Resources of Liberia* recently issued by the U. S. Department of Agriculture and the U. S. Department of State.

The booklet points out that the commercial development of Liberian forests depends upon the building of roads and markets. At the present time the value of the timber does not warrant the cost of constructing the roads needed to get it out, if the entire expense falls on the timber operator.

Markets are developing, however, because of the shortage of hardwoods in Europe. The English and French particularly are carrying on tests to determine how West African timber can be used. Progress is slow because of the great variety of tropical hardwoods found in these forests. Of 245 tree species identified in Liberia, only a few dozen are recognized in world markets.

Purpose of the study, made between 1947 and 1949 under the direction of the Department of State, was to survey Liberian forests and to recommend a program for the protection and development of the forest resources.

The study took the author of the bulletin, Karl R. Mayer, now assistant chief, foreign forestry section, division of forest economics, U. S. Forest Service, into interior forests which had never been examined. He made seven major field trips, with very little equipment and no technical assistance.

The booklet deals mostly with the procedures and findings of his survey, but a few pages are devoted to the conservation problems and the commercial importance of the forests. Fire, insects, disease, and wildlife do little damage to the forests there.

Greatest loss of timber comes from clearing the land for short-term farming. Approximately 50,000 acres are converted from bush or high forest to farm clearings each year. The people allow the land to grow back to bush in a few years; then they clear it again.

The 72-page booklet, containing a map and charts, is available from the Superintendent of Documents for 20 cents.

Redwood Group Seeks Better Utilization

Victor H. Clausen has been appointed to the Research and Technical Division of the California Redwood Association and will make his headquarters at the association's Eureka, Calif. office.

Clausen was formerly a wood technologist for the Coos Bay Lumber Company at Coos Bay, Ore. He replaces Willard E. Pratt who was transferred to the association's main office in San Francisco. A graduate of the University of Minnesota in wood utilization, Clausen will aid in research work aimed at improving the manufacture and utilization of redwood lumber.

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Council Discusses Stability of California Lumber Industry

Members of the national-forest advisory council, representing the public as counselors to the U. S. Forest Service in matters of policy, have met with Regional Forester Clare W. Hendee to discuss sales of government timber, particularly in northwestern California where the current rate of cuting is much below the sustained-yield capacity. The discussion centered on a program of timber sales that would result in the establishment of a stable lumber industry and stable communities.

Members of the advisory council include Samuel B. Morris, general manager, Department of Water and Power, City of Los Angeles; Bestor Robinson, Oakland attorney; W. S. Rosecrans, Los Angeles, chairman State Board of Forestry; Barney Mayes, San Francisco, American Federation of Labor; Dr. Claude B. Hutchison, Berkeley, dean of the University College of Agriculture; A. B. Hood, Anderson, general manager of Ralph L. Smith Lumber Co.; Carl F. Wente, San Francisco, vice-chairman, general executive committee, Bank of America; and John H. Guthrie, Porterville, livestock operator.

The annual cut from California's national forests is 750 million board feet, but the maximum capacity under sustained yield is 1.2 billion board feet. The members of the advisory council felt that an increase in national-forest production would have beneficial effects by relieving pressure on private timberlands, and that releasing old-growth stands from stagnation would increase the net rate of growth several times.

To reach a sustained-yield goal of 1.2 billion board feet within five years, heavy investments in roads to open up inaccessible timber would be necessary. The Forest Service would have to invest about $4.5 million annually and industry $3.1 million, to be followed by a total investment of at least an additional $3 million by industry in secondary and spur roads. The council felt that the government should build access roads only when industry could not, and that a stable industry would be able to handle much of the job. The importance of prompt action on road construction was stressed, for purposes of fire protection and salvage of timber before further losses from insects and diseases occurred.

Nearly one-half billion board feet of timber are being wasted each year in California's national forests, since any possible growth increase in virgin stands is usually offset by natural losses.

New Hardboard Utilizes Waste Wood

National sales and promotion of a new hardboard are to be conducted by the Simpson Logging Company of Seattle, Wash. The new product, to marketed as Simpson Allwood Hardboard, is manufactured by the Oregon Lumber Company at its new plant at Dee, Ore., and the entire production of hardboard will be sold through the Simpson organization.

This new hardboard is the result of several years of intensive research by experienced wood chemists. The manufacturing process employs the use of the entire output of waste slabwood from Douglas-fir mill operations, and can be modified to include the use of other slabwoods such as ponderosa pine, hemlock, and white fir. Termed the Lighthall-Anderson process, its commercial feasibility and many advantages have been proved and demonstrated by laboratory and pilot plant work.

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First edition published in 1940 included the first 50 Tree Pest Leaflets published with indices to most trees, insects, and diseases. The *new* edition has been largely rewritten and brought up to date and includes 55 subjects. A list of scientific and common names of trees is added.

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Wood Preservers to Meet

The 48th annual meeting of the American Wood-Preservers' Association will be held April 21 to 23 at the Hotel New Yorker, New York City. An attendance of about 800 members and guests is expected.

Reports of activities during the past year will be presented at the three-day meeting by the Preservatives Committees, Methods of Treatment Committees, Utiliziations and Service Records Committees, Information and Technical Development Committees, etc.

Also scheduled for presentation at the meeting are papers by leaders in the field of wood preservation.

Aerial Photo Short Course

An aerial photo interpretation short course will be given at the University of Georgia, April 21-24. The course is being sponsored by the School of Forestry, the Department of Geography and Geology, and the Division of General Extension of the university as a service to professional foresters and others working in the field of forestry.

The course will be kept on a practical level with only enough theory introduced as is necessary to the proper use of the instruments and aerial photographs.

Enrollment in the course will be limited. No tuition will be charged, but a registration fee of $3.00 will be required. Further details may be obtained by writing the School of Forestry, University of Georgia, Athens.

Tree Planting Demonstrations Conducted at 24 Schools

Twenty-four schools in 19 counties have planted 27,500 pine seedlings this year according to W. J. Barker, leader, Clemson Forestry Extension Work. He says that eight of the plantings using 12,000 seedlings were made by negro schools.

The purpose of these plantings is to give young people experience and to create an interest in tree planting; to establish demonstrations in forestry convenient to the schools; and to provide income for the benefit of the students through the sale of thinnings.

The plantings were a cooperative project with the Clemson Extension Service and the State Commission of Forestry working with the schools and the pulp industry including the International Paper Company, West Virginia Pulp and Paper Company, Champion Paper and Fibre Company, and the Union Bag and Paper Company. Approximately 620 people took part in the actual plantings of the seedlings.

This project was started in 1948. Since the start 108 schools and one church have planted a total of 199,000 seedlings in 37 counties.

Sawdust Useful as Mulch But Nitrogen Must be Added

Home owners and gardeners may find sawdust and other wood wastes useful for mulching or soil improvement, especially when it can be obtained at little cost other than hauling, say U. S. Department of Agriculture soil scientists. Addition of supplemental nitrogen will be necessary, however, to overcome the depleting effect of the sawdust on the nitrogen in the soil.

Approximately 0.8 pound of ammonium sulfate or 0.5 pound of ammonium nitrate or their nitrogen equivalent should be added per each bushel of loose sawdust or other wood waste such as chips.

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Forests and Wisconsin Economy

According to the Wisconsin Conservation Department, the great dairy state has more than 60,000 people employed in wood and wood products industries, more than are employed in the manufacture of all food and beverages, including dairy products, meat, and beer. Total forest products payroll in 1950 was $200,000,000, and the primary forest industries manufactured products having a sale value in excess of $480,000,000. This value is equivalent to 60 percent of the sale value of all products from Wisconsin farms. The forest industries, including woodsworkers and remanufacturing plants, employ more than 15 percent of all the people employed in Wisconsin manufacturing.

Wisconsin has 1,800 small sawmills and 52 pulp and paper mills. The drain on existing forest stands for all purposes is estimated at 427,300,000 board feet and 1,600,000 cords. In addition, Wisconsin annually imports about 700,000,000 board feet of lumber. Wisconsin is apparently holding its own in saw timber. Twenty-two years ago it was estimated that this state had about 12½ billion board feet of saw timber. Ten billion board feet have been cut since that time but the state is still estimated to have that same amount of standing saw timber.

The state has about 16,000,000 acres of commercial forest land, almost half of the total state land area. If the average growth rate were a half cord per acre on 8,000,000 acres and 200 board feet per acre on 8,000,000 acres, there could be an annual harvest of 4,000,000 cords and 1,600,000,000 board feet of saw logs. Reducing this estimate by 25 percent would still indicate a production of 3,000,000 cords and 1,200,000,000 board feet annually. That would provide employment for double the number of people now employed in primary forest industries with a possible similar effect on secondary industries. Nearly 11,000,000 acres of the total 16,000,000 acres is privately-owned, a condition that will continue, and much of the forest future depends on the private land owner.

Wisconsin has some 6,500,000 acres of farm woodlots, more than a third of all the state's forest lands.

Veneer Log Grades Study

Dr. E. S. Harrar, wood technologist, Duke University, is spending a 6-month sabbatical leave conducting studies on hardwood veneer log grades in the Southeast for the Southeastern Forest Experiment Station, U. S. Forest Service.

He will watch the peeling of thousands of logs at veneer plants and try to evolve a simple system of judging defects from external indications such as knots, catfaces, birdpeck, etc.

While with the Forest Service, Dr. Harrar will be associated with Dr. George H. Englerth, of the Forest Utilization Service at the Southeastern Station, Asheville, N. C. Englerth has been with the station for about one year, coming there from the Forest Products Laboratory, Madison, Wis.

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Tropical Wood Stronger Than Oak

A tropical hardwood almost five times stronger than white oak has been uncovered during a 5-year tropical wood testing program at the Yale School of Forestry.

The wood, hitherto untested scientifically and virtually unknown outside its native habitat, comes from a medium-sized tree known as kaneelhart.

Tests at Yale showed it to be one of the strongest and heaviest woods in the world, according to Frederick F. Wangaard, associate professor of forest products. In addition to being five times stronger than white oak it is nearly half as strong as aluminum, although it weighs only a third as much as the metal.

The unusual properties of the wood were discovered during exhaustive tests undertaken by the Yale Forestry School and sponsored by the Office of Naval Research.

The project already has tested 75 tropical hardwoods and is designed to seek replacements for woods such as teak, oak, and other timbers now standard for various types of naval use.

The kaneelhart tree (*Licaria cayenneusis*) is found in about 40 varieties in Central America and along the northern coast of South America. A member of the laurel family, it is a distant relative of the sassafras.

The wood has such high wear resistance that it would make a hard-as-iron and practically indestructible threshold for doorways. It can be machined to a mirror-like finish.

Using the white oak (with a norm of 100) as a yardstick in the various tests so far, kaneelhart was found to have a crushing strength of 467; a bending strength of 311, more than three times that of white oak; and a density of 168, two-thirds greater than white oak.

Fellowships, University of Michigan

The board of trustees of the Alumni Fund of Michigan State College again offers seven predoctoral and one postdoctoral fellowship for study at Michigan State College. Predoctoral fellowships ranging in value from $800 to $1200 are open to candidates for the Ph.D. degree. The postdoctoral fellowship has an annual value of $3000 and is, like the predoctoral fellowships, open to qualified candidates in any field of research for which Michigan State College has the appropriate facilities. Inquiries should be addressed to the Dean of the School of Graduate Studies, Michigan State College, East Lansing. Completed applications must be received before May 1, 1952.

West Coast Directory

The 1952 edition of *Where to Buy*, the membership directory of the West Coast Lumbermen's Association, is now available for distribution.

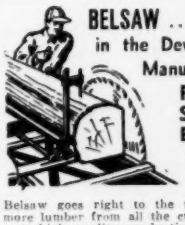
The record production of the sawmills in the Douglas-fir region of western Washington, western Oregon, and Northern California is reflected in the largest membership ever shown in the 48-page directory. Included are pertinent details on each of the 297 operations named. Information covers capacity, facilities, species, and lumber items manufactured, as well as a growing list of lumber by-products.

Free copies of *Where to Buy* may be obtained by writing the West Coast Lumbermen's Association, 1410 S. W. Morrison, Portland 8, Ore.

New Consulting Service

The establishment of New England Forest Industries, Inc., is announced by Walter L. Koenig, chief forester for the new organization. Owned, directed, and operated by professional foresters, the company will provide forestry consulting and timberland management services. The office is located at 3 North State St., Concord, N. H.

NEW RANGERS GRADUATED—Valedictorian and officers of 31-man class of '52 at New York State Ranger School at Wanakena are congratulated on their graduation February 20 by, *left*, Prof. James F. Dubuar, school director, and Dr. Hardy L. Shirley, acting dean of State University of New York College of Forestry at Syracuse. The semi-professional training division of the college, the Ranger School will begin its 40th year when the class of '53 registers March 17. It is the oldest and one of only six ranger schools in the U. S. New graduates pictured, beginning third from left, are Kenneth L. Meyers of Oswegatchie, N. Y., valedictorian; Sanford Shelton, New York City, secy-treas.; Robert B. Rochester, Rouses Point, N. Y., vice pres.; and Joseph P. Muehleck, Albany, N. Y., president.



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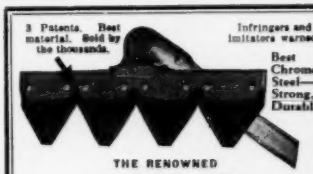

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Forestry Employment

S.A.F. members wishing the Journal's assistance in securing forestry employment are privileged to insert from one to three, consecutive, 60-word advertisements in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiation.

Positions Available

Foresters wanted for temporary seasonal positions as pine appraisers in the pine region of the Sierra Nevada mountains of California and Oregon to be filled about May 20 or soon thereafter. Training given after reporting. CSC Grade GS-5; no examination required. Dependents cannot be accommodated. **For details, write Blister Rust Control, U. S. Department of Agriculture, 2288 Fulton Street, Berkeley 4, Calif.**

Positions Wanted

Forester, 24, B.S.F. Idaho 1950, desires permanent employment with forest-owning or wood-utilizing firm in the South. Interest in silviculture. Two years' experience with U. S. Forest Service in fire control and timber stand improvement work. References and details on request.
Box B, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S. 1923 graduate with U. S. and foreign experience in general forestry, desires position with progressive forest industry in U. S. or foreign country. Now employed as forester in middle-west. Reference and detailed information on request.
Box E, Journal of Forestry, Washington 6, D. C.

Forester, M.F., Yale 1947, age 31, desires relocation in East for better opportunity. Now employed as scaler, lumber grader, and time-keeper for pulpwood and sawmill industry in Northeast. Experienced in cruising, mapping, land survey, sawmilling, lumber grading, pulpwood and log scaling, logging camp clerking, blister rust control work, fire lookout and suppression. Army training as photogrammetrist Married, 3 children. Further details and references upon request.
Box F, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F.; 45, married, desires job in Southwest, preferably Arizona. Twenty years experience in practical forestry, forest protection, and utilization. S. A. F. Member. Will consider any offer in forestry, nursery, forest protection, utilization, manufacture, or sales. References and details on request.
Box G, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, B.S., M.S., married, no children, 30 years old, desires position in private industry with concern large enough to insure advancement if capabilities are proven. Present duties at hardwood mill are operation of dry-kilns and yard supervision, also buy stumpage and supervise cutting and logging. Have knowledge of hardwood rules; familiar with all phases of mill operation.
Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 38, with very successful 16 year supervisory record in woodland management, procurement, logging, and sawmill management for large operations desires to relocate for better opportunity.
Box J, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F. and M.S. 27, married, one child; experienced in woodland management, fire control, pulpwood operations, and job supervision; desires position in management with private company. References and details upon request.
Box K, Journal of Forestry, Mills Building, Washington 6, D. C.

Forestry graduate, M.F., 31, married, World War II veteran. Experience with government farm forestry program and cruising for a wood products industry. Desires permanent position with private forestry organization. Details upon request.
Box L, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B. S. from N.Y.S. College of Forestry. Age 28, single. Experience of 3½ years with government agency in the Northwest, as forester, Timber Sales Management. Work entailed supervision of timber sales, marking, scaling, surveying, and fire suppression. Opportunities for advancement and future outlook main objectives. No regional preferences. References and details upon request.
Box M, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, six years well-rounded experience in forest management, administration, timber cruising and sales, aerial photo interpretation, land appraisal, and purchasing. Sound experience with many types of timberland. Am now land appraiser and buyer in government employment. Desire new employment for better opportunity with pulp industry or government.
Box N, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S. in general forestry, will receive M.F. in forest management June 1952. Five years well-rounded experience in forest management and utilization, including administration of logging contracts, timber appraisal, fire control, and public relations work. Desire position in forest management, but qualified for utilization work. Veteran, age 31, married, Junior member S.A.F. References and detailed information upon request.
Box O, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S. degree, Member S. A. F., now employed as forester with Naval Installation, desires permanent position with future in industrial or state organization. Veteran; 6½ years' experience management loblolly pine and hardwood forest types in coastal Virginia; management plans, cruising, buying and selling, and personnel supervision. Age, 33; Married, 2 children. Top references; experience summary upon request.
Box Q, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 27 years of age, desires better opportunity. Have had 3 years' experience in private industry including mapping, drafting, planting, fire control, growth studies, timber cruising, and land acquisition. Reference and detailed information upon request.
Box R, Journal of Forestry, Mills Building, Washington 6, D. C.

Experienced forester with legal background desires position combining field and office work with progressive company. Family man, age 37. B.S.F. and LL.B. degrees; forestry and logging experience in New England, Virginia, and Northwest; legal experience includes timber taxation, contracts, and abstracting titles. Presently employed as logging engineer and legal adviser to a medium-sized lumber company. Details furnished upon request.
Box S, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 28, with experience in federal forestry and private industry. Presently employed in forestry department of private concern. Veteran, married. Desire position with industry in forest management. Details and reference on request.
Box T, Journal of Forestry, Mills Building, Washington 6, D. C.

29 year old veteran, single. B.S. in forest management, lumber merchandising, and wood utilization. Experience in county forest management. On Federal Civil Service list.
Box V, Journal of Forestry, Mills Building, Washington 6, D. C.

New Forestry Consultant

Harry E. Murphy left the Tennessee Valley Authority in February to become a partner in the Southern Timber Management Service of Birmingham, Alabama. He joins John W. Bradley, Jr., founder of the consulting firm.

Murphy has been with TVA since 1947. He served three years with the Corps of Engineers in the European Theater of Operations. Prior to his TVA employment, he was with the Arkansas Division of Forestry and the U. S. Forest Service. He graduated from Penn State Forestry School in 1943.

Murphy will open a field office in Sheffield, Alabama. His business address: 404 Montgomery Avenue.

New Canadian Bulletins

Four bulletins have been published recently by the Canadian Forest Products Laboratories Division, Department of Resources & Development:

Red Alder in British Columbia, by K. W. Rymer, gives general and specific information on the characteristics, physical and mechanical properties, manufacturing processes, and utilization of Red Alder (*Alnus rubra* Bong) which now ranks fourth among British Columbia's commercial hardwoods.

Factors Influencing the Manufacture of Sawlogs into Lumber in Eastern Canada, by G. E. Bell, is a report on studies made at 50 sawmills in New Brunswick, Ontario, and Quebec. The investigations were aimed at determining the many factors affecting lumber recovery and the incidence of waste. Studies were also made of mill equipment and operating methods to determine their relation to economic production and volume recovery from sawlogs of various diameters.

Effects of Chemical Treatment of Pulpwood Trees, by D. C. McIntosh, is a summary of the work done by the Forest Products Laboratory, Ottawa, on chemical aids in bark removal and on the effects of chemical treatment in reducing the weight and improving the floatability of wood.

Sawdust as Fuel in Eastern Canada is a study of the fuel value of sawdust from wood species sawn to lumber in eastern Canada, and its suitability for use in domestic burners and industrial installations.

These bulletins are available on request from Forest Products Laboratory, University of British Columbia, Vancouver, B. C., and Forest Products Laboratory, Pretoria and Metcalfe Streets, Ottawa.

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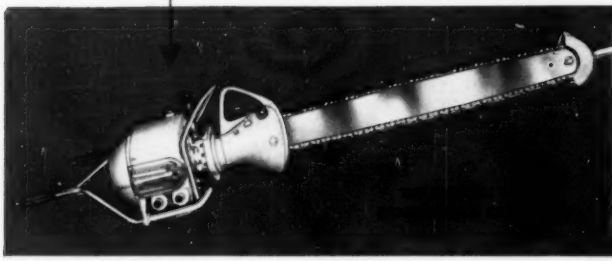

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